The
Electrical Review

VOL. CXIII. DECEMBER 1, 1933. No. 2923.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

THE ELECTRICAL REVIEW, DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1.

Telegraphic Address: "AGEEKAY, WATLOO, LONDON." Code, A B C. Telephone No.: Hop 3333 (50 lines).

The "Electrical Review" is the recognised medium of the Electrical Trades and has by far the largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d. Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to ELECTRICAL REVIEW, LTD., and crossed "Lloyds Bank."

For List of Foreign Agents for the ELECTRICAL REVIEW see Advertisement Supplement.

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The Trolley-bus Succeeds

THE decision of the London Transport Board to seek powers to convert a quarter of its tramway system to railless operation indicates that the trolley-bus is officially regarded as the successor to the tramcar.

This is of great importance to the electrical industry, as the present consumption by the tramways in Britain is over 400 million kWh per annum, and our manufacturers have incurred considerable expenditure in developing trolley-bus equipment. Moreover, electric transport depends on home fuel and the electricity so produced tends to decrease in cost and is not subject to the price fluctuations of petrol.

The ninety route miles to be changed over will add 40 per cent. to the mileage of railless electric traction in this country, and will be five times the existing mileage in the London area. The main reason for the present conversion is, we believe, the desire to avoid the heavy cost of relaying certain tracks in outlying districts, and at the same time to maintain through-running. As the cost of the trolley-bus scheme per mile is less than one-tenth of that of track renewal, it is clearly a sound course to adopt where the traffic density permits.

The extent to which the conduit system is used in London is a complicating economic factor in future developments. Its maintenance is costly, as the conduits form an only too convenient sump for water and rubbish. The same prejudice against overhead construction probably does not exist now as it did in some municipal boroughs when the tracks were originally laid. The supports need be very little taller than modern street-lighting standards, for which they would in many cases be suitable; consideration might well be given to the use of spun ferro-concrete poles for the common purpose.

A change of attitude towards overhead work is shown by the proposed extension of trolley wires from Euston Road to the Oxford Street corner of Tottenham Court Road. We believe that opposition to the overhead system would be reduced if an all-insulated system with 300 V to earth were adopted, and we see no need for the retention of an earthed negative and 600 V above earth, which is now involving the Municipal Tramways and Transport Association in difficulties with the Postmaster-General owing to electrolysis.

The practicability of the trolley-bus as the principal public vehicle of the future is due to the great technical advances that have been made since the earliest types were put into operation. During the past twenty years the weight of the driving motor has been reduced from 70 to 12 lb. per h.p., and improvements in design have culminated in the production of 74-seater 80-h.p. vehicles, which have a carrying capacity equal to that of a tramcar and are of a weight well within the permissible limit of 13 tons.

The trolley-bus has advantages over competitors in giving the high acceleration, ease of control, and reliable braking needed for modern traffic conditions. Not the least important of its qualities is that it is generally regarded by unbiased people as providing the means for the most comfortable transport of passengers.

Crompton-Parkinson Progress

WHEN referring a year ago to the controlling interest that Crompton-Parkinson, Ltd., had acquired in the British Electric Transformer Co., Ltd., Mr. F. Parkinson said that when the reorganisation of the latter company was complete there was good ground for hope that it would become a sound profit-earning business. That his forecast was not too optimistic is obvious from a study of the figures that have just been issued. The directors of the Transformer Company report that a loss of £10,266 for the complete year 1932 has been turned into a profit of £18,463 for the nine months ended September 30th, 1933. This has enabled them to pay the preference dividend of 5 per cent. and to carry forward £1,049. Thus, in the short period of nine months great strides have been made toward the state of affairs

predicted last December. It will be recalled that by virtue of their holding in the Tranformer Co., Crompton-Parkinson, Ltd., secured control of the Kye lamp business, a department of the concern which has lately displayed great enterprise and is making rapid progress. The figures that are also issued this week regarding Crompton-Parkinson, Ltd., and are given in our "City Notes," show an advance in the profit of that company from £96,309 to £102,187, enabling a total distribution of 12½ per cent. plus bonus shares to be made among the ordinary shareholders, while the general reserve is increased by £25,000, and £50,618 is carried forward.

N.W. England Grid Tariff

THE publication by the Central Electricity Board of a grid tariff for North-West England and North Wales means that at the New Year the Board will be engaged in trading operations over an aggregate area of nearly 34,000 square miles, the population of which is about 29,000,000, or 65 per cent. of that of Great Britain, tariffs having been previously introduced for Mid-East England, Central Scotland and South-East England. The North-West England area contains 16 per cent. of the inhabitants of this country, and its size is more than 10 per cent. of the total area. It includes a large number of manufacturing towns concentrated on the banks of the Mersey, with a wide range of heavy industries, and also provides scope for rural electrification. Thus, Chester Corporation has more than 300 farms connected to its mains, and the Lancashire Power Company is making rapid headway. Last year 2,300,000,000 kWh was generated—a considerable proportion most efficiently; this represents an increase of 50 per cent. over the 1926 figure, in spite of the industrial depression there. Only the South-West England and South Wales area now remains to be provided with a grid tariff, apart from the two areas where considerable work has been involved in frequency change-overs, *viz.*, North-East and Central England.

The Young Idea

THAT one of the best ways to make people electrically minded is to get them used to electricity from childhood is a truth that the Electrical Association for Women has done very good service in promulgating in the appropriate quarters. The Yorkshire Electric Power Co. has given a very practical demonstration of its belief in the efficacy of this method of training its future consumers. The company has lent the Guiseley County Senior Mixed School a panel complete with junction box, meter fuses, sockets with three-pin plugs and other similar fittings, so that children may acquire a knowledge of how to use domestic apparatus to get the best results, to read the meter, and to become familiar with simple electrical facts. The use of the telephone and of traffic signals is also brought under this practical method of giving children a real understanding of the world in which they will live as consumers. Apparatus has been supplied by various electrical firms which, together with the Y.E.P., we hope will receive their reward in days to come in an extended use of electricity.

Nose-closing and Eye-opening

WHEN commenting in the spring of last year on Professor Sir Leonard Hill's statement regarding the alleged adverse effects of the emission of infra-red rays from dull electric fires, we urged that the electrical industry should do something about it. The Electrical Research Association has now issued a record of experiments which shows conclusively that there is nothing whatever in his theory. There is no evidence of the existence of nose-opening rays; there is plenty that nose-closing rays come just as much from bright sources, including gas fires and even the sun, but these do not affect normal people. As non-luminous heating is likely to provide rapidly increasing scope for electricity, we hope that the widest prominence will be given to the conclusions formed by the authoritative medical and scientific committee which conducted the tests.

Industrial Power

FURTHER evidence of the increased activity of the British Electrical Development Association is provided by the supplement which is included in this week's issue. In the lay Press frequent advertisements are stressing the virtues of the "Wizard in the Wall" which connotes electricity in the home. The supplement to which we refer deals principally with the other broad aspect of electrical application—power in industry. Two fields are indicated in which electricity could work wonders in rejuvenating and increasing efficiency—coal and textiles. Another page deals with the vast subject of electric heat in industry, and the case is put in a brief but convincing way. Electricity in the home also receives attention in the supplement, and altogether the latter should prove very useful to those who have to present the case for electricity in various spheres.

Weeping and Wailing

AN American electrical contemporary urges the electrical industry to quit weeping and wailing over the National Recovery difficulties, and to proceed to make money on the present volume of business and increase that volume. Industry is now informed that it must build its own recovery platform as it can no longer afford to operate on a deficit basis! It is even told at this late hour that it must reorganise and inform itself so that it may sell a rehabilitation instead of an expansion market; that it must introduce cost finding and market statistics in order to fix a balance of production against consumption. "Industry must change its attitude." "The first requirement for recovery is the adoption of a successful sales psychology." "Leave the wailing wall," says our contemporary—industry must rely upon itself for recovery action—what can you expect the Government to do to increase the volume of business? and so on. Poor words of comfort these from the leading organ of an industry which has had to submit to control of hours of labour, prices, and obey innumerable commandments according to Government code.

Good News from Birmingham

THERE are many straws floating about nowadays to indicate that the trade wind is freshening and changing direction. Such is the latest news from the Birmingham Electric Supply Department. At last week's meeting of the Committee it was announced that during the month a further 4,200 h.p. was connected up in the power section and authority was given to enter into agreements for a number of additional large industrial supplies. The Midlands is one of the districts that have been the most badly hit during the past two or three years, so that a revival of trade there is of greater significance than improvement in the south. It is also clear that better trade means an immediate call upon the electricity supply mains, with beneficial effects upon our own industry.

Gas Efficiency!

THE chairman of Glastonbury Corporation Gas Committee, as reported in a local paper, believes that 20,000 cu. ft. of gas will do the same work in the home as 2,400 kWh. As gas is supplied at 5s. 10d. per 1,000 cu. ft. and electricity at £2 10s. per annum (for the size of house considered) and 1d. per kWh, he declares that electricity costs twice as much as gas. Apparently the happy gas consumers in Glastonbury have discovered methods of using gas that allow of heat efficiencies more than twice as high as those attainable elsewhere. There must be some very strong objection to this gas in other ways, since, in spite of the miracles that can be performed with it, the Mid-Somerset Electric Supply Co. is kept quite busy substituting electric cookers and wash boilers for their gas counterparts.

Prominent People at Last Week's Electrical Industries Benevolent Association Ball. **(See page 769)**

Ship Electrification. By J. F. Amor

A market which still awaits exploitation by the electrical industry

THE two tugs *Acklam Cross* and *Lectro*, which have recently completed their trials and whose equipment was described in the ELECTRICAL REVIEW of October 20th, have not received so much attention in the popular Press as the liners *Queen of Bermuda* and the *Normandie*, but most of the shipowners in the British Isles must be equally interested in the smaller vessels. Electric propulsion is the only feature that all these vessels have in common, for even the two tugs will be operating under different conditions.

These tugs are the only ones in the British Isles with electric drive but in the United States alone there are over fifty electric tug-boats, and on the Continent such craft have been in service for a considerable time. Tugs operating in Antwerp harbour are equipped with electrical gear of British manufacture, and so excessive caution on the part of shipowners has probably been responsible for the delay in this country.

Mr. J. F. Amor

To-day almost every type of vessel, from transatlantic liners to tugs and dredgers, is equipped with electric propelling machinery, and even in China there is a Diesel-electric ferry. There are also electrically driven warships, and the British Admiralty, which is a body naturally opposed to risky experiments, has had in service for some years a mine-layer with Diesel-electric drive.

Yet out of well over 200 electric ships in the world only one, apart from the tugs, operates in British waters. This is the R.M.S. *Lochfyne*, owned by Messrs. David Macbrayne, Ltd., which was put into service in the summer of 1931, the electric drive showing to advantage on account of the manœuvring qualities required. This is a small vessel designed for carrying tourists in the summer on the Staffa-Iona-Oban run and for passenger and mail service on the Clyde between Ardrishaig and Greenock in the winter. British shipyards have produced many more electric ships, *e.g.*, the two *Bermuda* liners, the *Viceroy of India*, the *Strathnaver* and the *Strathaird*, all of which are turbo-electric, as well as the Diesel-electric tankers *Permian* and *Winkler* and the Diesel-electric *Cementkarrier*, but these are employed for service outside the United Kingdom under the British flag or for foreign owners.

Exhaust turbo-electric auxiliary drives have been fitted to a number of Ellerman ships, two P. & O. liners and a fruit carrier, and have given coal-burning ships a new lease of life. The auxiliary drive is essentially a British idea and, although great interest has been expressed in other countries, no foreign-owned ships have yet been so equipped. Most shipbuilders are also engine builders and are more likely to look for improvements in the engines they build than to adopt enthusiastically machinery manufactured by a different industry. The Diesel engine was only reluctantly installed in British ships when foreign shipowners, by its use, had become formidable competitors of British owners on many trade routes where coal-burning steamers were obviously at a disadvantage.

Conservatism to be Overcome

Diesel engine developments are themselves directly important to the electrical industry, for their use encourages the installation of electrically driven winches, windlasses, pumps, &c., aboard ship. Reluctance to use the oil engine gives some ground for thinking that sheer conservatism is responsible for the slow progress which the electric drive has made in this country, although it is extremely difficult to prove that adding generators and propulsion motors, and perhaps dispensing with high-efficiency gears, results in a gain in overall efficiency.

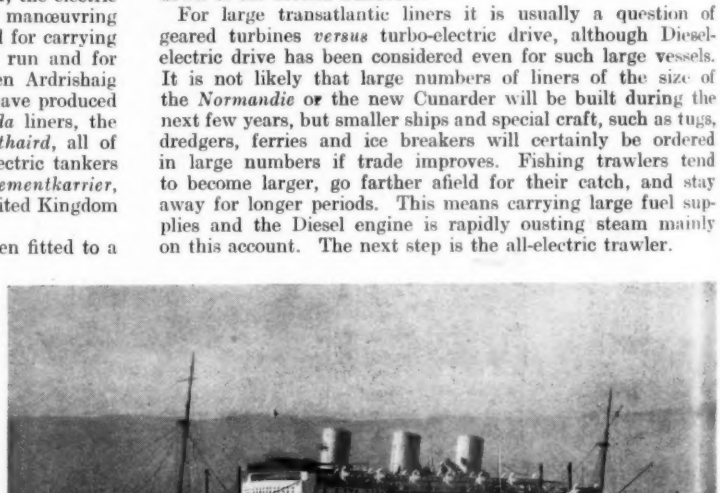
Electrical people maintain that in general shipbuilders tend to design the ship first with direct drive and then try to adapt it to the electric drive, instead of designing the vessel in the first instance to utilise all the advantages of electric propelling machinery, which often allows of machinery arrangements that give increased accommodation space or an alteration in hull design leading to savings in many directions. The advantages of flexibility in engine room arrangement are exemplified in the Swedish ice-breaker *Ymer*, in which Diesel-electric propelling machinery was the only way of obtaining the power required in the space available.

There are still marine engineers and others, who regard electrical gear as less reliable than steam engines, and the idea that mechanical couplings are more positive has certainly tended to prevent the more extensive use of electric steering gear, for instance. Yet marine engines are not required to perform such heavy duties as are large power-station generators which run for months on end continuously without chance of overhaul, or rolling-mill motors which reverse frequently on full load and stand up to rapid changes of loads within extremely wide limits. Moreover, submarines depend on electricity for their motive power below the surface and a modern warship operates vital services electrically. Intensive co-ordinated efforts are being made to educate the general public on the advantages of electricity for domestic and industrial purposes with the object not only of selling electricity but also to sell more apparatus and cables. So far no similar organised propaganda has been carried on in the marine market.

When the Revival Comes

Shipping, in spite of the depression, is still one of our largest industries. Even if trade does not revive, new ships will be built, for most of those laid up cannot be run economically. There are still hundreds of ships without electric light aboard; many fishing vessels depend on acetylene lighting. If there were over two hundred electric ships in the British merchant fleet the proportion would not be too high, for Britain is still the largest shipowner and the largest shipbuilder in the world. France will have the credit of the first transatlantic liner with electric drive when the *Normandie* goes into service, and although there may be conflicting views on the subject of electrical propulsion for such liners, French electrical engineers managed to convince marine opinion that the advantages were all with the electric ship. Their success should encourage the electrical industry in this country to look forward to the laying down of the second Cunarder.

For large transatlantic liners it is usually a question of geared turbines *versus* turbo-electric drive, although Diesel-electric drive has been considered even for such large vessels. It is not likely that large numbers of liners of the size of the *Normandie* or the new Cunarder will be built during the next few years, but smaller ships and special craft, such as tugs, dredgers, ferries and ice breakers will certainly be ordered in large numbers if trade improves. Fishing trawlers tend to become larger, go farther afield for their catch, and stay away for longer periods. This means carrying large fuel supplies and the Diesel engine is rapidly ousting steam mainly on this account. The next step is the all-electric trawler.



The *Strathnaver* (22,500 tons), one of the twin electrically propelled ships of the P. & O. line

The electrical industry should direct attention particularly to Diesel-electric propulsion for special craft. Oil engines developed specially to suit the electrical manufacturers' requirements for marine work will be certain to find an expanding market but more co-operation between engine makers and electrical engineers is necessary to real progress. The electrical industry is tackling the domestic electrical proposition in a big way and using all its huge technical and selling resources in a concerted plan. If ship electrification is tackled in a similar manner by joint action the results are certain to be of enormous benefit to every branch of the electrical industry.

Static Balancers. By G. L. Porter, M.I.E.E.

A survey of the conditions under which their use is to be recommended

IN an electrical circuit having single-phase loads connected between the outers and an intermediate or neutral conductor, any inequality or out-of-balance in the loading of the outers causes current to flow in the neutral; the resulting voltage drop due to the impedance of that conductor reduces the voltage of the most heavily loaded phase or phases and increases that of the more lightly loaded. A static balancer converts outer-to-neutral load into load between outers, and by so doing it not only obviates voltage drop in the neutral but reduces the drop in the outer associated with the excess load.

Mr. G. L. Porter is advisory engineer to Messrs. Ferranti, Ltd.

In a three-wire single-phase system the static balancer takes the form of a simple 2/1 auto-transformer (fig. 1). If the voltage across the outer terminals of the balancer is maintained constant, any fall in voltage between the mid-point and one outer, due to out-of-balance load, will necessarily be accompanied by a rise in voltage between the mid-point and the other outer. Thus the voltage out-of-balance, *i.e.*, the difference between the higher and lower voltages, is twice the reduction from normal in the lower one. The three-phase balancer also has two equal windings on each leg, but the connections used are those known as "interconnected star" (fig. 2); the vector diagram indicates how the six equal vectors give the necessary relation between neutral and outers.

Any displacement of the neutral point towards the most heavily loaded outer will again cause a rise in voltage between the neutral and the other outers, but, due to the phase-angle, the voltage out-of-balance will now be only 1.5 times (instead of twice) the fall in voltage of the loaded phase. Thus, when a three-phase balancer is guaranteed to have a regulation not exceeding 2 per cent., this means 2 per cent. fall in the voltage of the most heavily loaded phase due to the impedance of the balancer windings, but only 1 per cent. rise in the others. If that voltage unbalance is considered excessive and a reduction is desired it is preferable to specify a correspondingly larger balancer rather than one of special low impedance design, and all inquiries should call for a guarantee of regulation.

The amount of out-of-balance to be dealt with should not be specified as a percentage of full load of the circuit unless it is clearly stated whether the reference is to full-load current or to full-load kVA. For a three-phase balancer an out-of-balance current of 30 per cent. means a kVA out-of-balance of only 10 per cent. Misunderstandings are least likely to occur if the maximum neutral current itself is specified.

When choosing the position for a balancer it is important to remember that if an out-of-balance occurs beyond the balancer the voltage drop due to that out-of-balance increases rapidly with its distance from the balancer, and is, in any case, a good deal greater than the drop caused by an equal out-of balance load at the same distance from the balancer but towards the sub-station. If considerable out-of-balance may occur at the tail-end of a distributor the balancer ought to be installed close to that tail-end. In the case of a distributor with two branches which are equally affected by out-of-balance, the balancer should be installed at the "tee" unless that point is too far from the tail-ends, when a unit near each tail-end will be needed.

Conditions Governing Use

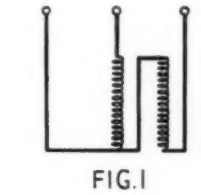
In l.v. distribution, voltage regulation is always the limiting factor, particularly in the case of lighting and cooking consumers where the voltage must be kept within plus or minus 4 per cent. of the declared pressure. On the other hand, the cost of the mains, and, therefore, the major part of the cost of supply to the consumer will be a minimum if the greatest voltage drop possible is allowed. The maximum voltage variation at the terminals of any consumer is made up of three items, (*a*) rise in pressure at light load due to out-of-balance, (*b*) fall in pressure at full load due to out-of-balance, (*c*) fall in pressure at full load due to the balanced portion of the load. The total of these three items must not exceed the maximum variation allowable, and as the voltage drop per kVA of load due to (*a*) and (*b*) is much higher than that due to (*c*), the maximum load will be seriously limited if (*a*) and (*b*) form a considerable part of the total.

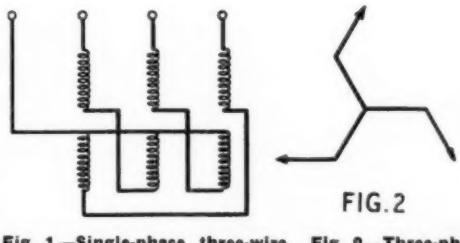
Voltage Regulation

This is shown by the following figures for a three-phase, four-wire distributor having a neutral of the same size as the outers. If 20 kVA be the balanced portion of the load on one phase, 3 kVA the maximum out-of-balance when the load of that phase is zero, and 5 kVA the maximum out-of-balance at full load, the total drop in that phase will be as much as that produced by $20+2(3+5)=36$ kVA of balanced load in each phase. The maximum load on the three phases will be $3\times20+5=65$ kVA, although the voltage variation in the most heavily loaded phase is equal to that produced by a balanced load of 108 kVA.

Further, if, as is usually the case, the balanced portion of the load is distributed along the length of the distributor while the out-of-balance, consisting—as is likely—of one or two cookers, may at times be concentrated near the tail-end, the figures become 65 kVA with a voltage drop corresponding to a balanced total of 156 kVA. If, again, the neutral conductor is of a smaller size than the outers, or the proportion of out-of-balance greater than in the above example, the disparity shown will be further increased.

The above figures represent extremely inefficient use of the copper available; where the neutral is of the same size as the outers, the installation of a balancer will allow at least 25 per cent. increase in maximum load for the same voltage variation, and with a half-size neutral something approaching 50 per cent. Fig. 3 shows an analysis of the voltage variation in a cable having a distributed balanced load and an out-of-balance current at light load of 12.5 per cent., and at full load of 25 per cent. of the full value of the balanced load current. The balancer thus permits of a 34 per cent. increase in load for the same amount of voltage variation.





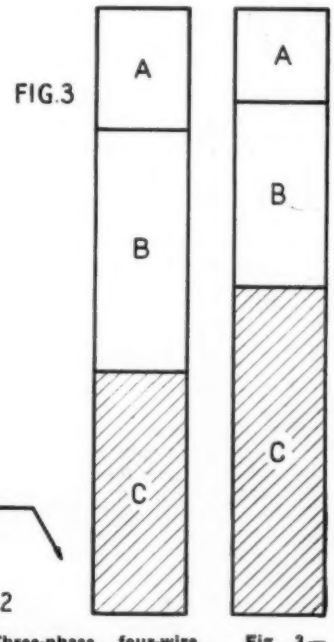


Fig. 1.—Single-phase, three-wire. Fig. 2.—Three-phase, four-wire. Fig. 3.—Analysis of total voltage variation: Left: Cable only; right: Cable with balancer

Although a static balancer converts out-of-balance load fed through it into load between outers, thereby reducing the voltage drop in the conductors, the impedance of its windings must also be taken into account. If such a balancer is connected to a distributor the out-of-balance load will be shared between the direct circuit from the sub-station transformer

and that through the balancer in inverse ratio to their respective impedances. This sharing of the out-of-balance load between the transformer and the balancer is essential for a satisfactory reduction in the voltage drop.

Effect of Cut Neutral

It is sometimes recommended that the neutral conductor be cut between the sub-station and the balancer and a choke

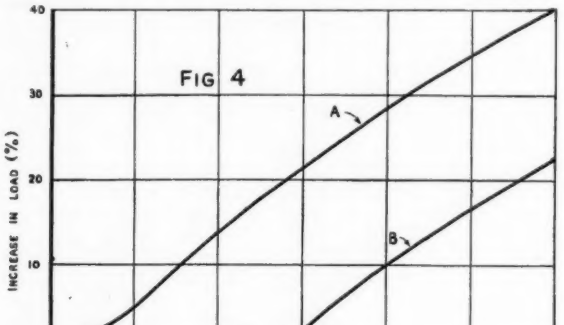


Fig. 4.—Increase in load made possible by balancer: A, with solid neutral; B, with cut neutral

inserted, but such a practice necessarily causes a large increase in the voltage drop. If the drop between the sub-station and the cut (due to out-of-balance load close to the cut) is the maximum allowable—say 3 per cent.—there will be 1.5 per cent. drop in the outer conductor and 1.5 per cent. in the neutral if these are of the same size. When the load is immediately beyond the cut there is no drop in the neutral between the sub-station and the cut, and the drop in the outer becomes 1 per cent. instead of 1.5 per cent., so leaving 2 per cent. for the balancer and the circuit beyond.

The average balancer has an impedance voltage of 2 per cent., so that the whole allowable drop will be absorbed by it, and no further length of distributor can be dealt with. If the neutral is continuous so that the out-of-balance load is shared between the balancer and the direct connection from the sub-station, a considerable extra length of distributor can always be dealt with, provided that all heavy out-of-balance load occurs between the balancer and the sub-station, *i.e.*, the balancer should be near the tail-end.

A further disadvantage of the cut neutral lies in the fact that the cut prevents an excess of load in one phase on one side of it being balanced directly by a deficiency in the load of the same phase on the other side. A considerable out-of-balance may occur in the voltage although the load on the distributor as a whole is as perfectly balanced as possible.

Fig. 4 shows the increase in load made possible by the use of a balancer on an average underground distributor with various values of out-of-balance; it also shows the much reduced gain obtainable if the neutral is cut. Fig. 5 shows how the impedance of the balancer affects the maximum load allowable, 100 per cent. being the load corresponding to the normal design having a regulation of 2 per cent. The static balancer is also of considerable value for providing a neutral where no other is available, as with delta-connected transformers, or where a long three-wire three-phase service was originally laid for power and a lighting supply is now required.

The Advantages Summarised

The following are salient points: (1) The installation of a static balancer will generally allow of a 25 per cent. increase in load for the same amount of voltage variation. (2) The balancer should be installed in such a position that all considerable out-of-balance loads occur between it and the sub-station. (3) The neutral conductor should be maintained solid throughout.

Full use cannot be made of the l.v. mains if the voltage at the sub-station falls due to pressure drop in the h.v. system and transformer; in such cases the provision of means of voltage regulation at the sub-station may result in a considerable saving in the cost of l.v. mains. If a regulator is installed and is compounded so as to vary the sub-station bus-bar voltage with the load, it will not only counteract the effect of h.v. pressure variation, but also the rise on the low voltage system due to out-of-balance under light load conditions, thereby increasing the voltage available for full-load drop.

Even if ideal voltage is maintained at the sub-station, and the voltage drop due to out-of-balance load is minimised by the use of a balancer, the time will come when no additional load can be connected without excessive voltage drop. In these circumstances the very small outlay required for one of the tail-end boosters such as that manufactured by Ferranti, Ltd., will enable additional load to be connected to an amount of between 30 and 60 per cent., depending upon circuit conditions.

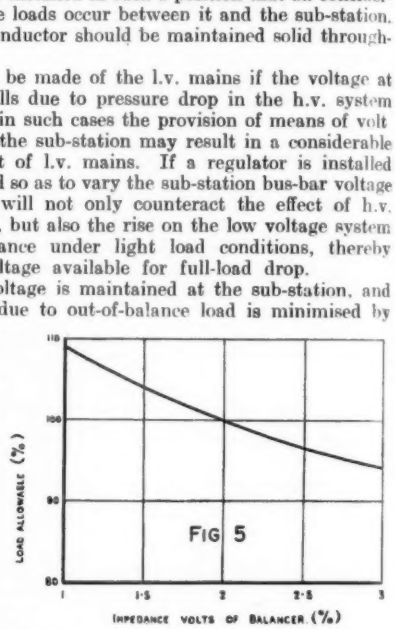


Fig. 5.—Effect of balancer impedance

Turbine Blading Materials.

By Sydney D. Scorer, M.I.Mar.E.

DURING the earlier stages of steam turbine development the problem of selecting suitable material for blading was one that was fairly easily solved owing to the moderate operating conditions obtaining at that time. Brass, because of its comparatively low cost and the facility with which it could be cold-drawn to produce the requisite blading sections, was extensively used and apparently gave every satisfaction.

The development of the impulse machine for high powers, with its fairly high steam speeds, however, led to a number of blading troubles, particularly with regard to blade erosion, and for a time turbine designers and metallurgists were greatly exercised in endeavouring to find suitable materials capable of withstanding the severe conditions. Nor was the reaction turbine without its share of blading troubles, and with a view to eliminating them the Parsons Co. undertook a series of experiments (extending over a number of years) on different blading materials, the results of which have only recently been made public. The gradual rise in initial pressure and temperature conditions during the last few years has increased the necessity for satisfactory blading materials, and although there is now a variety of copper and steel alloys offered, a clear understanding of the blading problem is essential to correct selection.

Any increases in turbine speeds and output with a given size of machine will result in increased loading of the blading and rotating parts. Neglecting for a moment the effect on the blading of high steam pressures and temperatures, each blade of a steam turbine is subjected, under working conditions, to a combination of stresses. In the first place, the high peripheral speed of the blade causes a centrifugal force to be borne by it, the value of the force depending on the blade weight and the square of the revolutions per minute.

In the last low pressure stages the resulting blade stress may be such that the requisite leaving area through the blades is unobtainable without having recourse to a double-flow l.p. cylinder, or some form of multi-exhaust blades. Further, since the torque due to the action of the steam is transmitted through the blades, each blade must be subjected to a bending moment, the intensity of which depends on steam velocity, blade angles, &c.

In addition, there is another variable force set up by the vibration of the rotor discs and blades, a force which, some years ago, was responsible for a number of blading breakdowns. Intensive research has determined the source of this trouble and has reduced it to a minimum.

The Effects of High Temperature

In conjunction with the stresses indicated above, the effect of high steam temperatures on the blading metal strength must also be given consideration, together with the deteriorating influence of corrosion and erosion. The tensile strength of brass, for instance, falls off rapidly as the initial steam temperature is raised, so that this failing renders it entirely unsuitable for the high-pressure stages of a modern turbine.

Again, whilst it is possible to obtain a blading material with adequate strength at high temperatures, it may fail in the property of corrosion-resistance, so that blades made of this material may have to be renewed after only a short period of use. Five per cent. nickel-steel is an example of a material which is an excellent blade metal from the point of view of erosion-resistance and retention of strength at high temperatures, but its behaviour in the presence of corrosive elements is such that it is not recommended for use in marine turbines or in land installations using water likely to be contaminated

by corrosive impurities. Similarly, high strength and corrosion-resistance may be obtained with other materials, but their resistance to erosion may be low.

Thus it will be evident that the problem of selecting blading material is not one of the easiest. On analysing the practice of various turbine manufacturers one finds that the materials used for blades may be divided into two broad classes—alloys of copper and alloys of steel with other metals. One of the oldest copper alloys used in steam turbine practice is brass with a 72 per cent. copper and 28 per cent. zinc content. This metal has the advantage of strongly resisting the corrosive action of any impure steam entering the turbine. Its resistance to erosion, however, is low, and its moderate strength renders it unsuitable for blade velocities of over about 300 ft. per sec. Moreover, at high temperatures above 400 deg. F. the strength of brass is considerably reduced.

Bronze Alloys

These disadvantages of brass led to the use of various bronzes in order to evolve a corrosion- and erosion-proof alloy. An aluminium bronze was extensively utilised at one time, the usual mixture being 88 per cent. copper, 9 per cent. aluminium, and 3 per cent. iron. The strength of this form of bronze was good, and its resistance to corrosion appeared to be fairly high, but practical experience showed that blades of this material wore out very rapidly under working conditions, and its use was therefore discontinued.

A nickel-brass has also been used for blading material, consisting of 50 per cent. copper, 10 per cent. nickel, and 40 per cent. zinc. This alloy was found to offer a good resistance to corrosion, but failed to meet requirements in regard to erosion-resistance. Further, its strength was reduced at high steam temperatures, and it was unsuitable for high speeds.

Manganese and phosphor bronzes have been found to be very suitable for blading materials, and give satisfaction up to temperatures of from 500 to 600 deg. F. A representative phosphor bronze contains 95 per cent. copper, 4.5 per cent. tin, and about 0.5 per cent. phosphorus, and offers strong resistance to corrosion. A copper-nickel alloy with 85 per cent. copper, 15 per cent. nickel is also satisfactory, and may be used up to about 650 deg. F. when the blade speed is moderate. Another well-known nickel-copper alloy—Monel metal—has been largely used for steam turbine blading and other purposes within recent years, and results obtained over a period of years indicate that this material is satisfactory. A rough analysis gives the composition as 67 per cent. nickel, 28 per cent. copper, and 5 per cent. of other metals.

Monel metal has a high tensile strength, which even at 750 deg. F. is over 36 tons per sq. inch. It has a strong resistance to corrosion and erosion, and the finished blade has a smooth surface which it retains during its working life, thus reducing frictional loss due to the passage of steam over the blade. It is claimed that blades of this material are unimpaired after seven years' use.

The other class of blading materials—that in which steel is alloyed with other metals—is one in which nickel and chromium play an important part. Mild steel has been tried for turbine blading, but its lack of resistance to corrosion and erosion make it unsuitable. A carbon steel used in Germany during the war, when material was scarce, had a composition including 0.21 per cent. carbon, 0.75 per cent. manganese, 0.06 per cent. phosphorus, but was quickly discarded as soon as more suitable materials became available.

In the nickel-steel alloys a high proportion (25 to 30 per cent.) of nickel was tried, and although this was strong and resisted excellently the onslaught of corrosion, it was found to be very unreliable. The subsequent life of blades made of this metal depends a great deal on the manufacturing treatment adopted, and while some high nickel-steel blades may last for years, others may become brittle and crack after only a few months' use. Their application, therefore, is not to be recommended except in special circumstances.

At the present time one of the most widely used blading materials in this country is what is known as 5 per cent. nickel-steel, a representative analysis showing this to include 4 to 5 per cent nickel, 0.3 per cent. manganese, 0.5 per cent. tungsten, 0.02 per cent. phosphorus, &c. It is used a great deal for blades subjected to high temperatures in the high-pressure stages of turbines, and gives satisfaction in most sections when chemically pure steam is used. Its strength remains fairly constant even at high temperatures, and it exhibits marked resistance to erosive influences. A further advantage, and one that probably accounts in part for its extensive use, is its comparatively moderate cost.

Steels containing from 10 to 13 per cent. chromium and about 0.5 per cent. nickel are also very popular for blading material, and retain their strength very well at elevated temperatures. They are known as stainless steel and iron, the former being hard and requiring careful heat treatment in order fully to develop its corrosive and errosive resistance. The softer variety—stainless iron—does not require such extensive treatment, and is used by a large number of turbine manufacturers in the high-pressure stages of their machines. The erosive resistance of stainless steels is very high, and any corrosion that does take place is but slight.

Materials for Different Stages

The correct selection of a blading material is one that must be governed by working conditions. For those stages subjected to high steam temperature a metal which maintains its strength and resists the cutting action of superheated steam is desirable. At intermediate stages a less expensive material may be utilised providing the stress conditions allow of this, whilst in the low-pressure stages, where the steam is partially wet, the use of a metal with a high erosion resistance is indicated. In connection with the latter effect, it must be remembered that the position of the wet zone varies according to the turbine load, and when a great deal of running on partial load is experienced the erosion-resisting material may have to be employed two or three stages nearer to the high-pressure end to allow for this.

A further point is related to the expected useful life of the turbine. If this is to be about fifteen years or so, then it is obviously cheaper in the long run to fit blades made of first-class material than to install cheaper blading and have to renew it in less than five years.

A New Plough Winch

A FIELD winch of simple construction has made its appearance in France, which enables a market gardener's plough to be operated electrically by one man only.

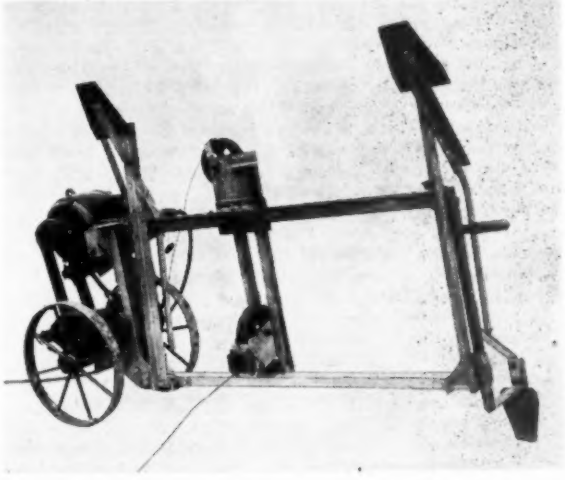
A robust frame of welded angle iron stands on a tripod with a spade tip to each limb holding it firmly in the ground, two at the front and one at the rear. On this frame slides a vertical cross-piece, which is provided with a locking system and two pulleys to guide the haulage cable. A 2-h.p. electric motor on wheels drives by belt a set of gears coupled to a drum on which the haulage cable is wound. Both the switch and the gears can be operated from a distance by a single lever, which is controlled by a cord held by the ploughman.

Should hard ground or other obstruction be encountered, automatic gear will cut the motor out of circuit. The machine is provided with 50 metres of steel cable, a power plug, and an earthing connection. The whole outfit weighs not more than 220 kg. (4 cwt.).

Six furrows can be ploughed without moving the winch, but if two winches are not used the plough has to be carried back across the field at the end of each furrow, which is somewhat of a disadvantage.

During a test at Saint Lambert des Levées a furrow 27 metres long and 27 cm. deep was ploughed in very clayey soil in wet weather. Placing the winch and paying out the control cord occupied 90 seconds, the ploughing time was 73 seconds, and carrying the plough back to the starting position for the next furrow occupied 32 seconds. The tractive effort registered by a dynamometer was 400 kg., the mean effort being 260 kg., and the electricity consumed 34 Wh, or 0.5 kWh are (rood).

The winch is illustrated herewith. A picture on page 773 shows the winch and plough in use.



The winch equipment described in this note

Power Factor Improvement. By C. R. Cooper

Advantages gained by the supply undertaking and the consumer

MANY undertakings stipulate a definite power factor, usually of the order of 0.8, when quoting a tariff, granting a bonus if this figure is improved upon and imposing a penalty if the power factor is lower.

In the more usual types of tariffs for power supplies the charge is based on (a) The maximum kVA demand plus a kWh charge; (b) the maximum kW demand plus a kWh charge; or (c) a kWh charge only. Where the tariff includes a kVA or kW charge, the power factor will be measured at time of maximum demand at whatever hour it may occur.

In estimating the saving resulting from power factor improvement, the most simple case is that in which the consumer pays £Y per maximum kVA demand per annum; under these conditions he has a direct incentive towards maintaining a high power factor.

Fig. 1

The net saving resulting from power factor improvement with this tariff will be affected by two considerations: (a) The higher the power factor the lower the maximum kVA demand for the same kW demand; (b) the more the power factor is improved the greater will be the annual charges incurred on maintenance, interest and depreciation of the condenser.

The Maximum Saving Possible

A simple method of finding to what figure the power factor should be taken in order that the saving may be a maximum is described below.

If £Y per annum per kVA of m.d. be the tariff charge and £L per annum the annual charges on condenser plant per idle kVA neutralised, the figure to which the power factor should be raised in order to show the maximum saving is $\sqrt{1-\left(\frac{L}{Y}\right)^2}$. This method of considering the economic limits of power factor improvement was first illustrated by the late Dr. Gisbert Kapp.

A more complex case arises when the consumer pays according to the maximum kW demand which he makes and is allowed a bonus for an improvement in his power factor above a stated figure and incurs a penalty if the power factor falls below this figure.

The most usual case in this category is where the bonus or penalty operates on the total revenue, thus depending on the kWh consumed as well as on the m.d., and, consequently, on the load factor. Let us assume first that the bonus or penalty applies only to payments in respect of the kW charge.

Assuming the bonus and penalty to be a constant figure for each 0.1 variation in power factor above or below 0.8, we may represent it as £X per kW per annum for each 0.1 variation, since the kW demand charge is known. The demand charge which the consumer will pay before improvement is effected will then be £[Y+10X(0.8−cos ϕ)]. Where £Y is the kW demand charge payable when the p.f. is 0.8 and cos ϕ is the power factor before improvement.

The gross saving which will accrue due to improvement from cos ϕ to cos ϕ_1 will be S_1=£10X(cos ϕ_1−cos ϕ) per kW.

The additional annual charges incurred on account of condenser plant required will be C=£L(tan ϕ−tan ϕ_1) per kW, £L being the annual charges on condenser plant per idle kVA neutralised.

Therefore, the net saving will be $S=S_1-C=10X(\cos\phi_1-\cos\phi)-L(\tan\phi-\tan\phi_1)$. Therefore $dS/d\phi_1=-10X\sin\phi_1+L/\cos^2\phi_1$, ϕ being a constant for any particular case.

Equating this to zero to find the maximum value, we have $-10X\sin\phi_1+L/\cos^2\phi_1=0$. Therefore $L/10X=\sin\phi_1\cos^2\phi_1$.

We may, therefore, draw a curve (fig. 1) for $\sin\phi_1\cos^2\phi_1$ and cos ϕ_1, and read off from it the economic value of cos ϕ_1 knowing L and X. Points which should be noticed about this curve are:—

(a) The minimum power factor to which it is most profitable to improve is 0.82 and this is so when L/10X=0.385. This means that if power factor improvement shows any saving for the consumer, it should be carried to 0.82 or higher depending upon the value of L/10X.

(b) For practical purposes the initial power factor does not enter into the calculations, as it is the ratio between the cost of condenser plant and the bonus gained that is the deciding factor. If, however, the initial power factor is abnormally low, the reading from the curve may possibly give the point at which minimum loss is sustained, instead of the maximum saving. This becomes immediately obvious when the actual cash saving is worked out as will be done in all practical cases.

(c) The dotted continuation of the curve denotes positions of minimum savings and so indicate conditions to be avoided.

Consumption on a kWh Basis

Where the consumer pays for energy on a kWh basis, either at a constant rate or on a sliding scale tariff, with the bonus or penalty operating on the total revenue, the tariff can be changed to the form of £Y' per kW for any load factor. This kW charge may be calculated by dividing the total revenue by the appropriate kW demand, which depends upon whether the power factor is to be taken on the maximum demand for the year or upon the average monthly demand.

If it is anticipated that the conditions of working will be altered at some future date, the position for any load factor may be calculated as follows: If F=load factor, expressed as a fraction, the kWh taken per kW per annum are F×8760. The annual sum payable in respect of kWh consumed will be £8760yF/240 where y is the average price per kWh in pence. This is equivalent to a kW charge of £Y'=£8760yF/240=£36.5yF per kW per annum.

To meet the case of a tariff of the form of £Y per kW of m.d. plus y pence per kWh, the principles outlined in the last two examples may be combined. The equivalent kW charge then becomes £(Y+Y')=£(Y+36.5yF).

Finally, we have the case in which a kWh rate tariff applies, and the penalty or bonus is also of the form of, say, X pence per kWh for each 0.1 variation in power factor above or below 0.8.

A rebate of this kind can be adjusted to the required form of £X per kW for appropriate load factors, and the curve may then be used as in the previous examples. The following example illustrates the application of the curve to a practical case.

A works making a m.d. of 100 kW consumes 200,000 kWh per annum. The tariff is £5 per kW per annum and 0.6d. per kWh, and there is a bonus or penalty of 2 per cent. on the total account for each 0.1 by which the power factor varies from 0.8. The capital cost of static condenser plant is taken as £3 per kVA, on which the annual charges for maintenance, depreciation, accommodation, &c., may be considered as 15 per cent., or £0.45 per kW=L.

The total annual cost of energy is £1,000 (*i.e.*, 100 kW at £5=£500, and 200,000 kWh at 0.6d.=£500)=£10 per kW per annum. The rebate for each 0.1 improvement in power factor=£10×0.02=£0.2 per kW per annum=X. Therefore, L/10X=0.45/10×0.2=0.45/2=0.225.

Interpolating from the curve, we see that the value to which the consumer should improve his power factor is 0.970. The formula S=kW [10X(cos ϕ_1−cos ϕ)−L(tanϕ −tanϕ_1)] then gives the total saving that will result from the use of a static condenser.

Extensible Cables for Shifting Ground

SATISFACTORY results have now been obtained for some years, says H. Heinzelmann in *Elektrotechnische Zeitschrift*, with a type of extensible cable developed by the Land u. Seekabelwerke, Köln-Nippes. The inextensibility of the copper conductors in ordinary cables results in abnormal stress when ground movements occur, due to mining subsidence or similar causes. This is overcome in the new cables by a special method of assembling and laying-up the strands. The flexible construction is applicable to all types of cables whether single or multicore, and whether with belt insulation or sheaths on individual cores.

Representing by p the percentage difference between the true length of a core and its effective length when laid up; by l the pitch of the lay; and by d the diameter of the circle on which the cores are laid, the value of p is about 0.5 per cent. when l/d=30, and 1.2 per cent. when l/d=20. If the cores be laid on a compressible central worming, the diameter d decreases when tension is applied to the conductors. This results in a greater effective length for the same actual length of core, *i.e.*, in a lengthening of the cable with only the stress required to compress the worming, and not the much higher stress required to stretch the copper. The extension obtainable by this means, however, is less than 1 per cent., whereas 5 or 6 per cent. extension without injury is obtainable in the cables with extensible conductors.

Helping the Amateur Gardener

A profitable field for supply development

WE would not dare to estimate, even roughly, the number of serious amateur gardeners in this country, but quite obviously half of them using electricity for encouraging plant growth would represent a handsome load for the supply industry. And there is no reason why this should not be achieved, for equipment is now available by which the desired results can be produced efficiently and economically.

We saw some equipment for greenhouse and frame heating recently at the works of Messrs. H. Church & Co. (Essex), Ltd., Chelmsford, and we were impressed also by some of the information regarding results imparted by Mr. Church.

Broadly, from the heating point of view, greenhouses can be considered under four headings: unheated cold houses; cool houses in which a temperature of from 40 to 50 deg. F. is required; intermediate houses heated to about 50 to 60 deg. F.; and stove houses requiring from 60 to 70 deg. F. of heating. The actual temperature required, of course, is determined by the class of plants grown, but the general requirement of the amateur gardener is about 40 to 45 deg. F., *i.e.*, adequate protection against frost, and it is upon the production of equipment suitable for this duty that the company has so far mainly concentrated its efforts.

The standard greenhouse heater consists of a small boiler equipped with immersion heaters, a simple circulating system and an expansion chamber. In some cases the boiler is fitted with a junction box with flexible leads from it for connection to a plug point and a thermostat, thus reducing the wiring to the minimum. The loading required depends on the type, construction and size of the greenhouse, on its situation and protection from cold winds, and on the temperature to be maintained in cold weather, but the company will undertake to calculate the adequate and economical loading required for any installation from particulars of these points given on a special form with diagrams representing different types of structures, with provision for dimensions and other particulars, which it issues.

Economy Should be Studied

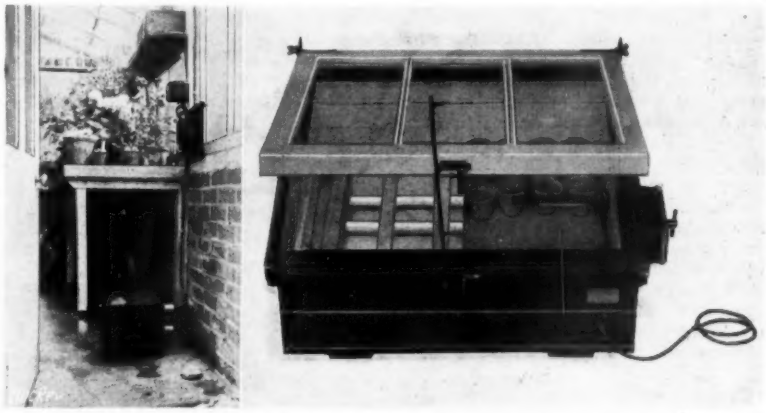
Mr. Church regards the relationship of the temperature required to be maintained in cold weather to the size and loading of the equipment as of the utmost importance. If an

The demonstration ground at Chelmsford

installation offered is capable of giving a higher temperature than is really necessary, it means that the loading is too high, the initial cost is increased, and a wrong and harmful impression is created. It is also important that the consumer should be discouraged from maintaining too high a temperature. Enthusiastic and uninformed gardeners will readily do this, resulting in higher consumption than is necessary, to their subsequent dismay.

We saw a private greenhouse installation which has been operated successfully for some time. The structure is of the lean-to type, 13 ft. long, 5 ft. 6 in. wide and with a capacity of about 550 cu. ft., and the 1,000-W heater is mounted under the staging. During the four cold months of last year, including periods of prolonged frost, the minimum interior temperature was 43 deg. F., and the average daily consumptions of each month were: December 6.5 kWh, January 13.0 kWh, February 6.2 kWh, and March 5.6 kWh.

The propagating and forcing frame is designed for use out of doors or in a greenhouse, and it enables the gardener to carry out his work in a small space at an economical cost for heating, with apparatus requiring little attention. When used outside, the frame can be employed to "nurse" young plants at the correct temperatures until they are ready for passing on to unheated frames, the dwelling house, or the garden.



Left: The private greenhouse installation for which results are given in the text. Right: An electric propagating and forcing frame

On an average winter day (twenty-four hours), *i.e.*, one with a day temperature of about 40 deg. F. and a slight frost at night, the standard frame, outside, will maintain a temperature of 60 deg. F. for a consumption of about 3 kWh. With the frame inside a greenhouse the consumption is considerably less because of the greenhouse temperature—probably at least 45 deg. F. Up to about 85 deg. F. can be provided in the frame. Tubular heaters are arranged from side to side in the lower section of the frame, and they have porcelain ends and are well protected from moisture from the plants above. These are arranged in pots, pans, or boxes placed in sand in trays supported over the heaters.

The light (glass top) is so arranged to afford ventilation at the front, back, or all round. The frame measures 3 ft. long, 2 ft. 2 in. wide, and 1 ft. 6 in. high at the back, will hold forty-eight three-in. pots, and is loaded at 275 W. A tubular air heater for fixing in an ordinary frame and soil-heating equipment are other products of the company.

A Demonstration Equipment

A testing and demonstration ground has recently been established by the company near its works on a main road to provide demonstrations of the various classes of equipment and to afford data and records of consumptions, &c., under various conditions of weather and internal consumptions. It consists of a span roof greenhouse fitted with heating equipment as described, an electric propagating and forcing frame, an ordinary cold frame fitted with an anti-frost heater, a frame fitted with soil heating equipment, and an unheated cold frame. A red pilot lamp in the greenhouse and frame circuits is proving of good publicity value by virtue of its switching "on" and "off" with the automatic thermostat control.

Thermostat control is, of course, all-important for all the equipment, and the system generally is an addition to the very many examples of the great advantages of electric over other services because of the ease with which automatic control is applied.

Load Factor Tables

To those engaged in negotiating power contracts and others requiring to ascertain quickly the price of electricity at any load factor, we can commend the simple method adopted by Mr. J. C. Petersen, secretary of South Shields Electricity Supply Department, for making such information available in a handy form. He has worked out for every unit load factor (with a few convenient intervening decimals, *e.g.*, 33.33) the equivalent hours per day, kWh per annum for each kW of demand and the pence per kWh at £1 per kW. The typed tables are bound up in a six-page booklet, about 8¼ in. in width by 6¾ in., the first page being occupied by an explanatory note and worked examples.

The New Fulham Power Station

An ultimate capacity of 300,000 kW

THE new power station which is now in course of construction at Townmead Road, Fulham, is being erected by the Borough Council, in collaboration with the Central Electricity Board and it has been "selected" under the South-East England Electricity Scheme, 1927. The site now occupied by the existing station will ultimately be used as a part of the coal storage accommodation. The capital expenditure on the new station is to be provided by loans raised by the Borough Council, but the Central Board will repay to the Council the annual charges for interest on and repayment of all loans raised.

As the result of a public inquiry the Electricity Commissioners formally consented on January 23rd, 1931, to the "extension" of the existing plant to a maximum of 318,000 kW in sections, the first section to be of 132,000 kW, subject to the prevention so far as might be reasonably practicable of the emission of smoke, grit, sulphur, and sulphur compounds.

Messrs. Preece, Cardew & Rider, and Mr. Arthur J. Fuller, the borough consulting and electrical engineer, are the joint consulting engineers and subsequently retained the services of Sir H. H. Dalrymple Hay, Messrs. Mott, Hay & Anderson, and Messrs. S. H. White & Son in connection with the civil engineering and building portions of the work, and Dr. R. Lessing in connection with problems arising out of the use of sulphur and grit elimination plant. Mr. H. Clarke is acting as resident engineer, on behalf of the joint consulting engineers.

The total area of the available site is about 10½ acres, with a river frontage of about 1,180 ft. Owing to the necessity of having to reinstate on other sites those firms whose lands had been acquired by the Council, it was not until September, 1932, that the Council was able to start the work. Contracts have already been let for the following works, the position with regard to each item being stated:—

(a) Demolition and excavation (£13,365): Messrs. E. D. Winn & Co., Ltd. Completed.

(b) Retaining walls and foundations (£117,085): Sir Wm. Prescott & Sons, Ltd. In progress.

(c) Structural steelwork (£383,616): Dorman, Long & Co., Ltd. In progress.

(d) Generating plant (120,000 kW) (£261,426): Metropolitan-Vickers Electrical Co., Ltd. In progress.

(e) Condensing plant (£38,661): Vickers-Armstrongs, Ltd. In progress.

(f) Steam-raising plant (£368,898): Stirling Boiler Co., Ltd. In progress.

(g) Turbine room cranes (£6,052): Clyde Crane & Engineering Co., Ltd. In progress.

(h) House turbo-alternator (10,000 kW) (£31,099): Brush Electrical Engineering Co., Ltd. In progress.

(i) Main switchgear (£290,718—Council £156,758, Board £133,960): Metropolitan-Vickers Electrical Co., Ltd. In progress.

Gas-washing Plant

During the last two years experiments have been carried out with experimental gas-washing plant at the existing power station, and a cycle of operation has been evolved which, while removing all grit and dust from the chimney gases, will give a very high degree of sulphur oxide elimination, and will prevent the necessity of discharging any, or only a small amount, of the washing liquor into the Thames.

The station has been designed ultimately to contain generating plant of 300,000 kW, consisting of five 60,000-kW turbo-alternators, and sixteen water tube boilers, each evaporating 260,000 lb. of water per hour. The first section will comprise two turbo-alternators and six boilers with one 10,000-kW auxiliary turbo-alternator. The working steam pressure will be 600 ib. per sq. in. superheated to 850 deg. F. The main alternators will generate three-phase at 11,000 V, which will be stepped-up to 66,000 V and fed into the transmission system of the Central Electricity Board.

Each boiler house in the completed station will contain eight boilers, in two rows of four each. Each boiler will be equipped with retort type stokers, superheater, air pre-heaters, economiser, forced- and induced-draught fans, with independent gas-washing plant above. Four chimneys will ultimately be built, each rising 300 ft. above ground level. Two chimneys only are included in the first section, built of reinforced concrete on a structural steel foundation above the feed pump bay. Each will deal with the gases from four boilers.

Coal will be brought to the station by colliers of about 2,000 tons capacity, or by barges. A jetty will be built in the river and the whole of the coal conveying plant will be electrically operated. The ashes will be removed by water carriage and stored in bunkers at the riverside, whence they can be discharged directly into barges. Two inlet tunnels will allow condensing water to flow by gravity from the river to the station, and the condenser discharge will be returned to the river by a single tunnel.

The main switchgear will be divided, ultimately, into five separate but interconnected sections, each dealing with one 60,000-kW alternator and four feeder circuits. The work now in hand includes three sections only.

The site and surroundings of the new Fulham power station

Nineteen Thousand Tons of Steel

The steel frame of the building now under construction involves the use of about 19,000 tons of structural steelwork, the heaviest member of which weighs 60 tons. The buildings will be of brick with stone facings. They will stand back from Townmead Road, the height gradually rising to the top of the boiler houses, which will be about 120 ft. above ground level. The value of the contracts already let (exclusive of the cost of the feeder switchgear, which is being purchased by the Central Board) amounts to over £1,350,000. It is estimated that the cost of the first section will be approximately £2,750,000. The station will remain the property of the Borough Council, but will be operated to the requirements of the Board.

The new station has already been of considerable value to the borough, as local labour is being largely used in its construction. From the beginning of operations up to October, 1933, an average of 260 local men has been employed with a maximum at one period, of 330 men. The station will also add largely to the rateable value of the borough, and it is anticipated that, when it is in operation, the Council will be able to obtain its electricity for its consumers in the borough at a much cheaper rate than at present.

The Life of Underground Cables

In connection with negotiations between the Liverpool Corporation and British Insulated Cables, Ltd., for the purchase of the supply undertaking owned by the latter, an examination of the existing mains was recently made. The cables in question were all made and laid by the B.I. Twelve places were selected by the Corporation for opening up, and twenty-four cables were bared. Although most of these had been underground for between thirty and thirty-five years, they were all found to be in excellent condition with the exception of an armoured cable (laid in 1898), from which the outer jute had disappeared; the armour was rusted, though still protective, and the inner jute showed signs of decomposition. Approximately 70 per cent. of these cables are of the armoured type and they are said to be among the oldest in the country. From this investigation it would appear that the periods allowed for the repayment of money borrowed for the construction of underground cable systems are quite conservative.

Another Grid Tariff

Terms of supply for N.W. England and N. Wales

THE Central Electricity Board is introducing on January 1st a grid tariff for the North-West England and North Wales area, which includes the counties of Cumberland, Westmorland, Lancashire, Cheshire, parts of Derbyshire and Shropshire, Denbigh, Carnarvon, Flint, Merioneth, Montgomeryshire, and part of Cardiganshire. There are twenty-nine selected stations in the area, including Clarence Dock (Liverpool Corporation), in which two 50,000-kW sets form the first instalment of the ultimate capacity of 350,000 kW; no decision has yet been taken regarding the erection of the proposed new station at Carrington, near Manchester. With the exception of Willowholme (Carlisle Corporation) all the selected stations are concentrated near the main load centres in the vicinity of Merseyside; the other principal stations and their percentage thermal efficiencies last year are: Agecroft, 19.68 (Salford Corporation); Barton, 22.02 (Manchester Corporation); Chadderton, 20.29 (Oldham Corporation); Hartshead, 21.29 (Stalybridge Joint Board); Kearsley, 23.71, and Padiham, 19.77 (Lancashire E.P. Co.); and Ribble, 18.08 (Preston Corporation).

Above: Grid lines crossing the Manchester Ship Canal. Below: Barton, one of the principal selected stations of the N.W. Area

For interconnecting the power stations and fifty-one transforming and switching stations, 316 miles of 132-kV main transmission lines and 199 miles of lower-voltage lines have been erected. The area is linked up with South Scotland, Mid-East England, Central England, and (at Crewe) with the hydro-electric stations of the North Wales Power Co.

Output and Population

The completion of an additional thirty-eight miles of secondary lines for a Barrow-in-Furness ring and a section between Egremont and Penrith of the Cumberland ring has been postponed. Last year authorised undertakings in the area generated over 2,300 million kWh, nearly eighteen per cent. of the total generated in Great Britain.

The bulk of the population of over 7,000,000 in the area of 9,082 sq. miles is centred in the industrial region in Lancashire and Cheshire, north and south of which the territory is mainly agricultural.

The new tariff comprises: (a) a service charge for more than one point of supply; (b) a fixed charge of £3 7s. 6d. per kW demanded in the four winter months, with a reduction of 4s. 6d. for each "standard increment of demand" to £2 14s. per kW, this charge being increased by 4s. 6d. for each 0.1 (and *pro rata*) by which the power factor is below 0.85; (c) a running charge of 0.2d. per kWh with coal of 11,600 B.th.u. per lb. at 15s. per ton, varied by 0.0009d. for each penny by which the cost is above or below 15s. For selected stations the fixed charge is increased or reduced by 1s. 10d. for each shilling or *pro rata* by which local rates on the stations are above or below 4s.

The standard increment of demand is the same as those for the Mid-East England, Central Scotland and South-East England Areas, and was set out in the report of the tariffs in the last-named area which appeared in our issue of November 3rd, page 634.

Electrical Benevolence

THE annual ball held in aid of the funds of the Electrical Industries Benevolent Association at Grosvenor House on November 24th was bigger and better than any before. Nearly 450 tickets were sold—many times the quantity required to meet all expenses.

After supper Lord Meston, the president, called for a penny collection from each table in the trays provided by Mr. J. Y. Fletcher. We suspect that many of those contributing did not play the game quite according to the rules, as the number of pennies received indicated a far larger number at the supper tables than the official record of tickets sold would warrant. But is not too meticulous an interpretation of the rules mere pedantry sometimes?

Lord Meston then introduced Sir William Ray, the new executive chairman of E.D.A., to the gathering, which was representative of all branches of the electrical industry as our artist has shown on page 761. Sir William declined to depart from the precedent tacitly acknowledged at this function that there shall be no formal speeches, and showed himself to be a man of very few words indeed on an occasion when many words would have been unnecessary.

The Marshmallow Cabaret was again one of the principal features of a most enjoyable evening, and the orchestra was held in high esteem up to the time that it surprised us all by playing "Auld Lang Syne," as it was thought that 2 a.m. could not possibly have come so quickly. Some people were rather in the dark as to what E.I.B.A. signifies, as they had got used to the old name of Electrical Trades Benevolent Institution in the guise of its initials (as is the way of engineers), E.T.B.I., and had forgotten the recent change of title.

The result of this year's collection will probably not be available for a few weeks yet, as subscriptions still keep coming in.

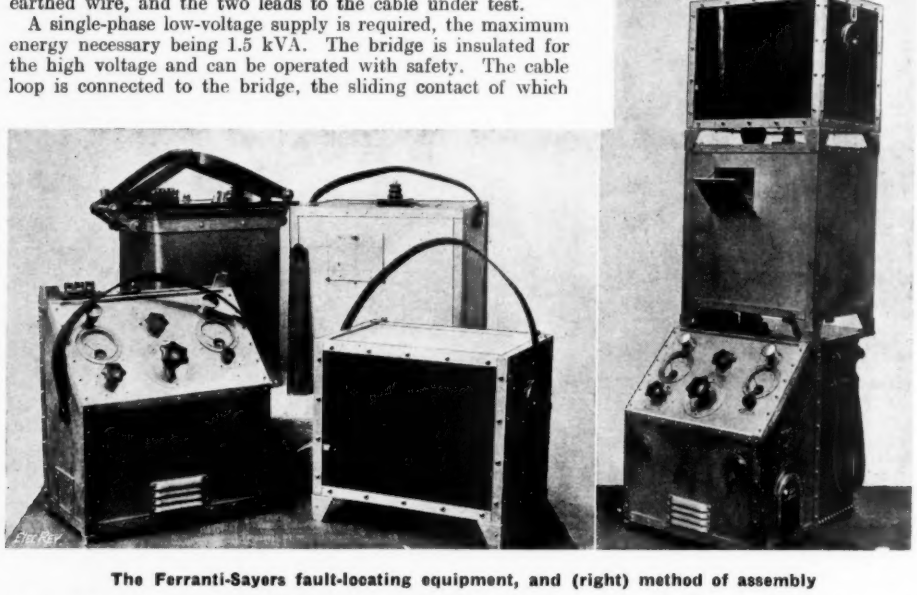
Portable Fault-location Apparatus

THE rapid and accurate location of faults is becoming increasingly difficult due to the increase in capacity, working pressure and length of individual cables. The Murray loop test, with variations to suit particular conditions, is the most accurate basic method of locating the majority of cable faults, but in view of the low voltages customarily employed, the resistance of the fault must be very much less than the insulation resistance of the healthy core used to complete the circuit; it must be low enough to pass several milliamperes.

Taking 10 mA as the lowest practicable value, with 200 V, 20,000 ohms is the highest resistance fault that can be located with accuracy. Faults on modern paper-insulated cables are frequently of much higher resistance than this figure, values of 2 to 20 megohms being customary, even with a 1,000-V test pressure. Attempts to lower the resistance of the fault by "bullying" with high-voltage tests are slow and cumbersome and usually subject the cable to surges which reduce its life.

The Ferranti-Sayers equipment retains the inherent simplicity of the Murray-loop method but increases the voltage available for testing to a figure approaching the normal working voltage of the cable. Particular attention has been paid to portability and to safety and ease of operation. The complete outfit comprises a control cabinet, a main step-up transformer cabinet, a valve rectifier cabinet producing 30 kV d.c. with one end earthed, and a bridge cabinet. This apparatus is fitted in four earthed metal cabinets, arranged so that they can be connected only in the correct sequence and position. Each of the cabinets is provided with a carrying strap and can be handled easily by one man. The heaviest unit is the step-up transformer which weighs 50 lb. The only connection wires necessary are the two low-voltage supply leads, one earthed wire, and the two leads to the cable under test.

A single-phase low-voltage supply is required, the maximum energy necessary being 1.5 kVA. The bridge is insulated for the high voltage and can be operated with safety. The cable loop is connected to the bridge, the sliding contact of which is connected through a null galvanometer to the h.p. supply.



The Ferranti-Sayers fault-locating equipment, and (right) method of assembly

The control cabinet carries an auto-transformer, the input terminals of which are provided with a selector switch to suit any supply pressure from 100 to 250 V. This transformer also gives coarse control of the voltage applied to the main step-up transformer and to the filament transformer of the rectifier valve, finer regulation being given, in each case, by a variable resistance in series with the respective tapping switch. Main and filament switches are fitted, together with a voltmeter to indicate transformer primary voltages or filament voltage and a two-range milliammeter to read the current passing to the fault. A series protective resistance is provided which can be cut out for final balance on the galvanometer. Two small lamps illuminate the instrument dials and a length of armoured flex carries a portable inspection lamp.

The main transformer cabinet is placed immediately behind the control cabinet and contains an oil-immersed transformer with a ratio of 150/15,000 V. The low-voltage terminals of the transformer are brought out to two of the blades of a triple-pole knife switch, which is thrown over to contacts mounted on the control cabinet. The third blade serves to take the supply from the control cabinet to the valve filament transformer. One end of the high-voltage winding of the transformer is connected to earth, the other being brought out to a spring plunger terminal on the top plate which makes connection with the rectifier valve when the valve cabinet is placed on top of the transformer cabinet.

An "Osram EHT2" rectifier valve is supported in rubber mounting in the rectifier cabinet which, under operating conditions, is placed on top of the transformer cabinet. The valve is carried in a bakelite housing which is easily removable from the cabinet. The filament transformer is also housed in the same cabinet. It has a ratio of 110/5 V and has its secondary insulated for the full voltage to earth. A two-range high-voltage milliammeter is fitted at the top of this cabinet and is read through a mirror placed inside a hinged door, range change being effected by a long, insulated handle projecting from the case. Operation of the switch and reading of the instrument are both quite safe at any voltage.

By placing the bridge cabinet on the rectifier cabinet the high-voltage connection is made through plunger-type terminals. This cabinet contains a bridge of the slide-wire drum type and a galvanometer. Removal of the top discloses a plate-glass panel, through which the bridge scale and the galvanometer can be read with safety, and removal of the back leaves the main terminals clear for the entry of the main cable ends.

The slide-wire drum is revolved by means of an insulated handle through a 10 to 1 reduction gear, and is quite safe to operate at any voltage. When the case is closed for transport the moving system of the galvanometer is clamped. The galvanometer switch can be used to short-circuit it except when the bridge is in use, thus protecting the instrument should the cable break down to earth whilst on test. Further and permanent protection is afforded by a neon lamp in parallel with the instrument.

In a large electricity supply undertaking which has had one of these sets in use for a considerable period, the mean error in location has been computed to be 1 yard in 2,000 yards for faults varying in insulation resistance to earth from one or two ohms to 1.5 megohms. These faults occurred in cables varying in length from 20,000 to 80,000 loop yards.

Liability to Electric Shock

IN the course of a paper recently presented to the Société Française des Electriciens, Dr. Uzac, the chief physician of the Cie. des Chemins de fer du Midi (France), describes an interesting series of tests designed to determine the predisposition of men and apprentices to injury by shock. The basis of comparison chosen was not the electrical resistance of the body, which varies with the path of current flow, but the relative skin resistance of the hands of different workers. This was determined by measuring the current flowing between two electrodes, each with an area of about 0.4 sq. in., placed side by side on the central grip area of the palm and fingers. The corresponding electrodes on each hand were connected electrically in parallel, and subjected to the same mechanical pressure in all tests.

On applying 20 V between the electrodes, the current varied in the case of adults from 0.1 to 0.9 mA when the subject was in repose, and from 0.3 to 3.8 mA after a period of exercise. In the case of the apprentices the maximum currents were heavier, 1.4 and 4.4 mA respectively. About two-thirds of thirty adult workers and about one-third of seventy-two youths were "poor conductors," passing currents of from 0.1 to 0.5 mA; while 17 to 20 per cent. of the adults and 20 to 30 per cent. of the youths were "good conductors," passing 0.6 to 1.4 mA in repose, and 1 to 4.4 mA after exercise. Some workers with very moist skin were found to be so sensitive as to be unable to touch a telephone or the bulb of a glow lamp without discomfort. It is suggested that the evidence already accumulated would justify the exclusion from electrical work of men in the "good conductor" class. Youths may become less susceptible as they grow older, but it would be a wise precaution to divert them to other employment if they are found to be specially liable to electric shock.

MEETINGS AND DISCUSSIONS

Current Topics and Opinions Expressed at the Institutions

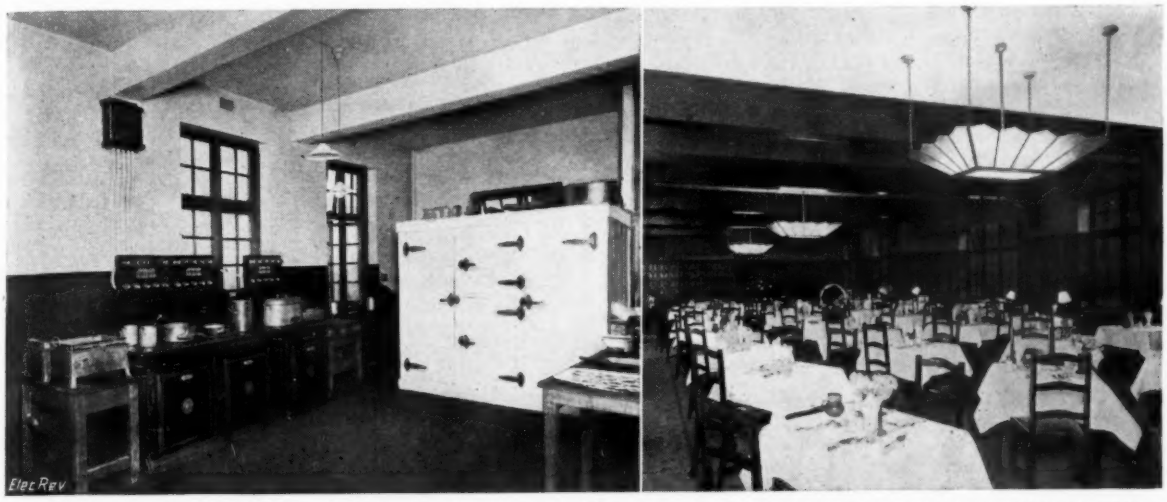
Empire Communication

IN the ninth annual Norman Lockyer Lecture, delivered in London on November 23rd under the auspices of the BRITISH SCIENCE GUILD, Prof. E. V. Appleton showed how the whole history of communication by electrical means, both by cable and wireless, has been stimulated by Imperial requirements. The whole of the Empire is now "on the 'phone," with London as the exchange.

The remarkable way in which wire and wireless methods undoubtedly supplement each other is often overlooked, and submarine cable communication is at present far from having reached its final stages of technical development. The speed of operation of wireless circuits is not limited by the wireless medium, but by the terminal apparatus. Short-wave transmission is not absolutely reliable, so that long-wave stations still have their uses to fill in the gaps when short-wave channels are interrupted. Wavelengths less than ten metres for a summer noon to twenty-three metres for a winter night are not suitable for long-distance wireless communication.

The fact that more than 10,000 reports on reception have been received in less than one year's Empire broadcasting is a striking tribute to listeners' enthusiasm. The keenness and spirit of co-operation of overseas listeners has been extraordinary and their reports have been of the greatest possible value and, as a result, pronounced improvements have been made in the service.

Originally vertical aerial dipole arrays were used with reflectors behind, the intention being to send out a narrow beam in the direction of each of the five zones scheduled as the service areas. But as a result of the reports received it was considered that an aerial system with a less directive projection would be better, and now single elevated horizontal dipoles without reflectors are being employed. At present the service to New Zealand is the least satisfactory, and it would appear that the best type of sending aerial for this area at the appropriate time of the day has not yet been found, but it is very likely that the difficulty will soon be solved. In the case of Canada the reason for the poor reception in mid-winter nights is recognised, but until longer wavelengths are available for broadcasting it appears impossible to improve it. It appears that a wavelength of about eighty metres is required. Unfortunately any wavelength between forty-nine and 200 metres is, by International Convention, not at present available for broadcasting purposes.



These pictures show the kitchen and restaurant of the Lady Workers' Homes, Ltd., Holly Lodge Mansions, Highgate. The main cooking equipment was supplied by Carron Company and a pastry oven by the British Electric Transformer Co. The large refrigerator is a "Frigidaire"

Short-wave communication, though more efficient than long waves, is less reliable over a period of time. Besides diurnal and seasonal variations in the electrification of the ionosphere, normal day and night variations are sometimes profoundly upset by changes in solar activity. Whatever the origin of the charged particles which impinge on our atmosphere as the result of solar activity, the general effect of the influx of ionising in the atmosphere is to alter the electrification and thus also change the properties of the ionosphere as a reflecting medium.

In our latitudes, with long waves a magnetic disturbance is usually accompanied by a lower nocturnal signal intensity, but the corresponding daytime signal may be actually increased. In the case of short-wave channels the result is almost always a markedly increased attenuation of the signals, often completely interrupting communication for days. This cessation of signals is now believed to be due to increased absorption of the waves due to abnormally high ionisation at levels below that at which the waves are normally reflected. In other words, it is due to an excess and not a deficiency of ionisation.

Interference Between Power and Telephone Lines

THE paper on recent investigations into power plant interference with telephone lines, by Mr. W. G. Radley and Dr. S. Whitehead, which was referred to last week, was discussed at the INSTITUTION OF ELECTRICAL ENGINEERS in London on November 23rd.

Mr. S. C. Bartholomew characterised it as a splendid example of both national and international co-operation between power and telephone engineers. He thought that the authors might have explained the reason for changing from the subjective to the objective method of noise testing. The latter had been developed by the G.P.O., and the British apparatus had proved to be superior to the German or American.

Earthing the neutrals of power lines was not general practice abroad; it tended to create more danger, but unearthed systems would give greater acoustic shock. The possibility of danger arising from direct earthing was very real. The provision of an earthing wire for the British grid had curtailed trouble by 33⅓ per cent. Mercury-arc rectifier interference was "moderate" with the third-rail system of traction, but very considerable when an overhead collector wire was employed. Shunts should always be fitted.

Dr. Alex. Russell commented on the authors' clever utilisation of relative mathematical, physical, and engineering theories, and outlined the history of certain mathematical functions used in the paper. Mr. J. A. Broughall said that the authors' experiments had not been prolonged sufficiently to determine whether filter circuits were really necessary for railway rectifiers. Elsewhere on third-rail traction systems the lack of filters had not caused interference.

Mr. C. W. Marshall stated that the 132- and 33-kV grid lines in this country had not caused any interference. References to "danger" suggested neglect somewhere, apart from communication circuits. What precautions did the G.P.O. take to protect its linesmen from lightning? Rapid clearance of faults was the sensible way of dealing with such troubles. Tests had proved that multiple earthing did not increase earth currents, and the presence of railway track reduced induced voltage in adjacent telephone lines by 70 per cent.

Col. H. C. Carter stressed the need for co-operation between power engineers and the G.P.O.; both had to live together. The Electrical Research Association should do more investiga-

tion of this sort, which was vastly superior to attempting to deal with difficulties locally as they arose in the areas of undertakers in which they were noticed. The G.P.O. noise-measuring equipment (exhibited at the meeting) was acknowledged to be the best of its kind. Mr. A. Broughton Edge explained the methods he had employed to prepare the earth-resistivity map of the British Isles, copies of which were exhibited by the authors. He believed it was the first of its kind.

Mr. G. C. Morris asked if high voltages could be induced by high-frequency switching and lightning surges, and whether they would be dangerous. Capt. A. C. Timmis referred to a series of tests now being made in Paris by the C.C.I. to determine the effect of noise on intelligibility and to ascertain how much noise could be tolerated on telephone lines. Mr. R. O. Kapp said that hitherto this subject had been investigated abroad, but this paper now showed that in high research this country was not inferior to any other. Was there any information about the relative "numbers" of disturbance caused by power systems and lightning? The G.P.O. Telephone Department should guard itself against trouble in the same way in both cases.

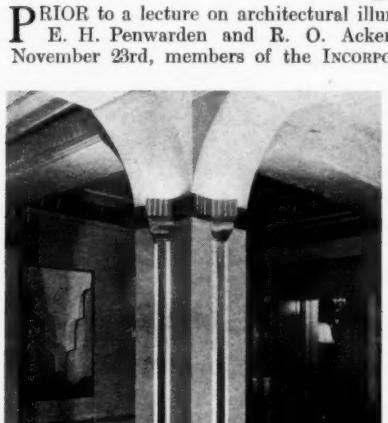
Mr. A. B. Frost commented on the striking difference between the authors' theoretical and measured coefficients of mutual inductance between earth-return circuits. A soil-resistivity figure had been recommended by the C.C.I. in default of more accurate knowledge; it was lower than the mean in this country, so that calculations based on it might need revision. Mr. P. D. Morgan remarked that the idea that on multiple-earthed systems the third harmonic and multiples thereof caused the main disturbance was erroneous, for residual currents could be much more troublesome.

Mr. J. Urmston said that some time ago he had had to decide on the risk involved in erecting a 345-mile telephone line along 132- and 66-kV power lines with a separation of from 150 to 300 ft. That line was now in successful operation, but if he had known then what the paper now revealed he would probably not have undertaken the erection of the line.

Dr. S. Whitehead replied briefly to the questions raised in the discussion.

Lighting in the Decorative Scheme

PRIOR to a lecture on architectural illumination by Messrs. E. H. Penwarden and R. O. Ackerley in London on November 23rd, members of the INCORPORATED INSTITUTE OF BRITISH DECORATORS visited the newly decorated G.E.C. showrooms at Magnet House, Kingsway, and paid special attention to a room which shows how light sources can be built in to form architectural features.



An example of "architectural" lighting

The lecturers analysed in detail the units which had been inspected with regard to their decorative effect, the internal construction necessary to produce the desired lighting effects, and the provision which must be made by the builder or decorator for the installation.

Mr. Penwarden considered that the decorative artist should include the lighting fixtures in his scheme, even though they might not be an intrinsic part of the building structure. Because when the owner or tenant of the premises selected standard fixtures, even with the advice of the local electrician, who might be an excellent craftsman but often entirely lacked artistic appreciation, an otherwise attractive decorative scheme might frequently be spoilt by the choice of unsuitable or misplaced lighting features.

He emphasised the importance of allowing adequate space for the provision of the necessary lamps and their controlling equipment, and the provision of suitable backings, such as wood battens set in the plaster in correct positions, for fixing the particular unit concerned. The positions of these backings varied in every instance, and while the cost of their provision would be negligible if they were included in the original specification, if not so provided, alterations to the structure might well become unnecessarily expensive. This showed the absolute necessity for co-operation between the lighting fittings designer, the decorative artist, and the builder.

Mr. R. O. Ackerley said that in built-in decorative lighting the amount of light obtained in the room for the wattage consumed was not great, and, consequently, it was of the utmost importance to control the light by reflectors in such a way that the maximum possible efficiency, under the particular circumstances, was obtained. The advantages of adequate offset, the use of curved backgrounds, and the lighting properties of different classes of glassware were demonstrated by means of simple diagrams, while the problems involved in concealing equipment below the sight line and in avoiding internal reflections were also explained. The importance of providing adequate space for housing the equipment was stressed, since this factor influenced the illuminating efficiency and decorative effectiveness quite considerably.

Radio Frequency Determination

METHODS and associated apparatus for the accurate determination of radio frequencies are the subject of a paper by Mr. F. J. Tompsett which was read before the London Students' Section of the INSTITUTION OF ELECTRICAL ENGINEERS on November 28th.

In the laboratory with which the author is concerned (Marconi's) the frequency source is an electrically maintained "Elinvar" tuning-fork, driving by means of a valve amplifier a phonic motor from which, by means of gearing, hour and minute hands are rotated, and two discs engraved 0-60 and 0-100 make one revolution per minute and one revolution per second respectively. The gearing is such that when the driving frequency is exactly 1,000 cycles per second the clock hands will indicate correct time, or vice versa. If the clock dials show correct time the driving frequency will be exactly 1,000 cycles per second. The two dials are illuminated once per second by the laboratory clock, and the drift of the discs is noted over a period of time. From this drift the frequency of the driving source may be calculated by a formula.

The method used to compare the low-frequency standard with the radio frequency to be measured is by means of a chain of oscillators of good stability which can be set in harmonic step one with the other and with the frequency to be measured. The final low-frequency oscillator is allowed to beat with the frequency standard and the resulting beat frequency recorded over a short period of time; it is then only necessary to make a short calculation in order to obtain the value of the required radio frequency in terms of the low-frequency standard. The advantage of the method described is its great flexibility of operation, while measurements with an overall accuracy of the order of ± 2 parts in 10^6 are obtained in the minimum of time.

* * *

Electro-medical Devices

Some of the uses of modern electrical apparatus for curative purposes were demonstrated in a lecture at Birmingham on Wednesday last under the auspices of the Birmingham and Midlands branch of the ELECTRICAL ASSOCIATION OF WOMEN. The lecturer was Mr. R. D. R. Holder, of Walsall, a bio-chemist and specialist in medical electricity. He first showed an apparatus for diagnosing infections of different parts of the head by means of a small light that penetrates the gums and the skin; he also mentioned an apparatus used for testing nerves, and, passing on to ray therapy, showed the "Hala" infra-red generator, capable of penetrating three inches of tissue. It is used for treating rheumatism, arthritis, colic, and almost any painful condition. Another form of heat-treatment shown was an electrically heated pad impregnated with radium salts. Mr. Holder also gave a demonstration with diathermy apparatus for heating any internal part of the body —in effect an internal electric poultice that can be applied without raising the skin heat to any appreciable degree. It is used for deafness and for cataract.

Metals for Low Temperatures

The mechanical properties of non-ferrous metals at low temperatures are considered in the paper, by Mr. E. W. Colbeck and Dr. W. E. MacGillivray, which was read before the INSTITUTION OF CHEMICAL ENGINEERS in London on November 29th. From the work done in the research laboratories of I.C.I. (Alkali), Ltd., at Northwich, it would appear evident that the excellent properties of the copper-nickel alloys, 70-30 brass, and nickel silver throughout the temperature range from 20 to minus 180 deg. C. will make them valuable materials for plant to work at temperatures below zero. These materials have been tested in the annealed state and their large reserve of ductility suggests that it would probably be safe to use many of them in a slightly harder condition.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

A Home-wiring Specification

In a recent letter to the *Times* the Director of the British Electrical Development Association stated that his Association had a "specification" for electric home wiring, copies of which might be had free on application to the Association.

The latter body has apparently solved a problem which has confronted engineers for many years and, I believe, also doctors. Engineers have always found it necessary to pay at least one visit to the premises to be wired before feeling themselves competent to draw up a specification for that wiring; similarly, doctors have always found it advisable to pay a visit to the patient before prescribing for that patient.

The British Electrical Development Association's solution of having just one specification to suit every contingency is surely the work of a wizard. D. WINTON THORPE.

London, S.W.1, *November 24th.*

Another Contractor's Plaint

I fully sympathise with Mr. Devenish's complaint in your issue of November 24th, as I have received similar treatment in this district of High Wycombe, Marlow and Bourne End. It is about time that sound business methods were adopted by electrical concerns; to my mind they seem incapable of foresight, the state always produced when there is no competition to ginger up affairs.

Returns of companies who co-operate with contractors, as in the Midlands, seem far to outpace in the number of units sold and return of profits those who seem to look down upon contractors as a nuisance. Far from this they are free salesmen, free demonstrators by their showrooms, &c., and cost supply companies nothing for the rates and taxes which they have to find for their showrooms, together with the large cost of attendant labour.

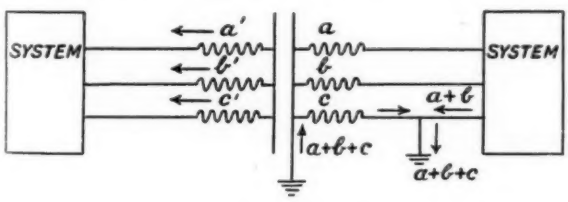
Other industries or manufacturers do not compete in such unfair ways with persons who sell their goods, not free but at a profit, and I can hardly see for instance such sound business being done, say, by the tobacco firms if they did the things which electricity supply authorities think fit and proper. I hope that the dawn of common sense is not far away.

November 24th. E.C.3.

Current Transformers

Fig. 1 of Mr. Robertson's letter in your issue of November 17th will apply whether the transformer be of the core or shell type or a bank of three single-phase transformers.

If in the two last cases no zero sequence currents can flow, of what is the total current IR in the faulty line composed may I ask? Positive and negative sequence systems have, naturally, no resultant current to earth, but that is not to



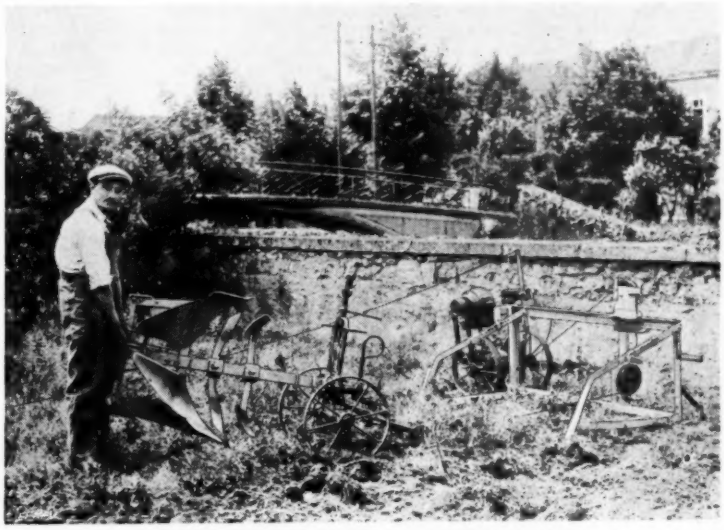
say that positive and negative components do not each form part of the current flowing to earth in the faulty line.

I have consulted the reference, *viz.*, page 116 of Messrs. Wagner & Evans' "Symmetrical Components," and find that they do suggest a similar analogy but not as a proof that zero sequence currents can flow in a star/star core-type transformer with free primary neutral. In observing that Mr. Robertson's analogy was inadmissible, I was under the impression that he was offering it as evidence of the existence of these currents; perhaps I ought to have added a rider to that effect in my previous letter.

While on the subject of references, I took the occasion to consult Messrs. Dannatt and Dalgleish's "Electrical Power Transmission and Interconnection"; on page 290 it is stated: "A star/star connection with only one neutral earthed presents an infinite impedance to zero phase sequence currents in the lines on both sides, since compensating currents cannot flow in the unearthed winding." These authors do not distinguish between the three types of transformer.

Finchley, N.3, *November 20th.* THOMAS ELLIS.

Referring to the correspondence between Messrs. Ellis and



The plough winch, described on page 765, in use

Robertson on the above subject, may I endeavour to clear the matter up?

The diagram shows a star/star transformer with one neutral earthed, and the other not, the currents on one side being a, b, c, and on the other a′, b′, c′. Then the zero sequence current on the right-hand side where there is an earth fault is $(a+b+c)/3$, and the current into the earth fault is $a+b+c$. The remaining components together are respectively:— $(2a-b-c)/3$, $(-a+2b-c)/3$, and $(-a-b+2c)/3$.

These are respectively equal to a′, b′ and c′ on a 1/1 transformation basis for simplicity. Thus $a'+b'+c'=0$, so that there is no zero sequence component on the other side.

The one side zero sequence component $(a+b+c)/3$ is a true magnetising current and will be negligibly small in single-phase banks and shell-type transformers, but may be larger in three-legged cores owing to the magnetisation being homopolar in the three legs and the flux having to return by the tank and air. This gives the effect of a high impedance delta winding, as Mr. Robertson says, which may, on the usual rating of full-load zero sequence current amount to anything from 20 to 60 per cent. PAUL MATHEWS, B.A.

Rugby, *November 20th.*

Interference with Radio Reception

We were interested in your Editorial of November 24th on this subject. One of the points that have intensified this annoyance is the increase in number of large repulsion motors which have been installed during a change-over in order to obtain improved starting torque. These latter are made in sizes up to 10 h.p., and where the brushes are in constant contact with the commutator interference is caused to wireless receivers over a wide area.

Our company had this matter in mind when it introduced capacitor-type starters which can be used with specially wound cage-type single-phase motors and cause no interference whatever. We stress the point of the larger commercial motor as we feel that the interference from these is widespread whereas the domestic size of motor causes only a very local interference. BROOK MOTORS, LTD.

Huddersfield, *November 24th.*

Overhead Road Crossings

The letter of Mr. F. R. C. Roberts in your issue of November 10th and that of Mr. H. Payn in the following issue disclose an attitude of mind which can only be described as lamentable. Either these gentlemen have not troubled to seek the reason behind the Electricity Commissioners' Regulations for road crossings or they choose to ignore it.

After all, the idea of providing duplicate insulators is not

to increase the sales of insulators but to secure a greater measure of safety for the public than is given at other parts of the line. The arrangement of two insulators side by side with duplicate conductors or with a bridle attached to the line-conductor a few feet from the pole—used almost exclusively until comparatively recent times—certainly achieved this object since in the event of the line conductor being severed by an arc the bridle would hold it up until repairs could be effected.

The arrangement of pin insulators in tandem is little or no better than the use of a single insulator, and apparently the Commissioners, realising this, have compromised to the extent of accepting the arrangement with the addition of a bridle above the cross arm. This construction does not appear to me to be nearly so satisfactory from a public safety point of view as the earlier arrangement of insulators side by side and complete with bridle.

I have been rather painfully surprised to observe that large and otherwise reputable concerns (both undertakers and consulting engineers) have descended to the tandem arrangement of insulators. I suppose on the whole one must blame the Electricity Commissioners for failing to word their Regulations more clearly, but surely it is not unreasonable to expect that engineers will observe safety regulations in the spirit as well as the letter and not interpret them—as Mr. Roberts apparently does—simply "according to the dictionary definition." ROAD-USER.

November 23rd.

Gas Nuisance in a Cathedral

In view of the vastly superior publicity which the gas industry (in particular) has engineered in the past, especially in the matter of occasional failures and of the hypothetical "fusing of an electric wire," evidence from absolutely impartial witnesses must be of value to the electrical industry. In an appeal by the Dean and Chapter for funds for the lighting and heating of Winchester Cathedral, the following statement occurs :—

> "Both the heating and lighting are urgent—not only to give better warmth and light in winter, but also because the fumes from the present direct heating coke stoves and from the combustion of gas are exercising an injurious effect on all metal-work and leather-work in the Cathedral. This includes the metal work on memorial tablets, the brass on several candlesticks and on the mortuary chests, the metal on the fine candelabra in the south transept and retro-choir, and the leather-work of the organ. There is also an increasing amount of escape of gas."

While the gasfitter, rather than the gas suppliers, is responsible for what we may parody as "the leaking of a gas pipe," there is no such excuse for the damage done by the fumes issuing from the burners. J. W. MEARES.

Chichester, *November 23rd.*

A Busman's Holiday

It is interesting to note that next year's I.M.E.A. Convention is to be held in Liverpool. But one really wonders whether the I.M.E.A. Secretary is serious or is indulging in a little leg-pulling, when he states that "we are sure that members will be delighted that we are visiting an industrial city." Some of us who spend approximately fifty weeks of the year in industrial cities must feel overjoyed at the thought of visiting *another* industrial city.

Perhaps it would have sounded a little better had it stated "the Convention this year will be held at Liverpool which is a sea-port." There is the consolation that a visit to an industrial city will not give the many city fathers the opportunity of raising the old-time cry of "going on a joy-ride or a picnic." What a pity the I.M.E.A. Council has not chartered a liner for a few days, so as to get the delegates away from the industrial atmosphere! However, success to the I.M.E.A. Conference! DELEGATE.

November 23rd.

Inefficient Driving by D.C. Motors

In response to Mr. Jordan's letter, I should like to make it clear that there was no suspicion of belt slip in either drive from the motor to the tested shaft, and the tachograph records reproduced can therefore be taken to represent the actual speed variation of the motor armature in each instance. Some belt slip was noted, however, between the countershaft of which the speed was recorded by test No. 3 and the machine head. This only served to make matters worse at the machine head than was demonstrated on the countershaft.

The governing formula determining the speed of any d.c. motor can be reduced, of course, to a simple proportionality of three variable terms only, namely; Speed $\propto$ back-e.m.f./flux.

Thus, the initial effect of putting a load suddenly on the machine is to reduce the speed and back-e.m.f. until sufficient current flows to develop the increased driving torque required (torque $\propto$ current $\times$ flux), and the percentage by which the speed is reduced is equal to the percentage voltage drop in the resistance of the armature winding, brushes, series and interpole field windings, and main leads, expressed as a percentage of full normal line voltage. On the one hand it is impossible, because of voltage drop, to maintain full line voltage on the armature, and, on the other hand, the flux cannot be altered suddenly.

It will be seen, therefore, that it is only after the initial drop in speed has occurred that the correcting effect of the differential compounding begins and the flux is then reduced at a relatively slow rate until the speed again picks up. Hence, the so-called constant-speed motor is by no means a constant-flux machine. But the flux variations are slow because the inductance of the shunt-field winding is large.

I readily agree that only a proportion of the privately supplied d.c. power load is of a rapidly varying character, such as to show up the behaviour of the d.c. motor at its worst. There should be no doubt, however, as to the gain in efficiency and economy to be secured by converting this particular section to a.c. driving. It would be a good start, and in the right direction. Good reasons of another sort, but equally sound, can be adduced for similarly converting the steady loads; among them is, of course, the temperature variation of the field windings already briefly referred to.

Bedford, *November 27th.* ERNEST W. SHORT.

Clearing Up Ambiguity

Referring to the leaderette in your issue of November 25th I most certainly do not agree with your opinion that "*Unfortunately*, the Corporation took Counsel's opinion which decided that the terms were *ultra vires*." I think it is very *fortunate* that the Taunton Corporation *did* take Counsel's opinion. Surely, before making an agreement involving possibly many thousands of pounds, it is the duty of a Corporation, if its Town Clerk has any doubt, to ensure that the agreement is good in law, as not even the Central Electricity Board can continue to honour an agreement which the Courts may decide to be *ultra vires*.

The whole object of the grid scheme is to reduce the cost of electricity to the consumer, but the general opinion of supply engineers of long experience is that the grid will result in electricity costing the consumer more rather than less. It is therefore incumbent on every municipal and company electricity supply undertaking to make quite certain that any agreement they may make with the Central Electricity Board is good in law. MUNICIPAL.

November 27th.

A Warning to Contractors

An answer to the fears of "E.C. and E.C.2" will be found in a reference to the presidential address to the Incorporated Municipal Electrical Association, 1933. The following quotation alone should suffice :—

> "Individuals and organisations will have no option but to leave the industry or to remain in it with much of their power of initiative curtailed. *Human wreckage cannot be avoided.*"

Manchester, *November 27th.* L. E. WILSON.

An Intrusive Plant

I read with interest and some amusement the letter in the current issue of your journal referring to the phenomenon of a fern having made its way into a kiosk sub-station at Lowestoft, growing to a height of six feet, and ultimately short-circuiting two phase contacts of the h.p. switch.

Whilst it may be a testimonial to the benefits of electro-culture, it is scarcely indicative of systematic inspection of kiosk sub-stations. It is usual to specify that kiosk sub-stations shall be vermin-proof, but evidently in future we shall require to specify that they shall be fern-proof also.

A. NICHOLS MOORE,
Borough Electrical and Tramways Engineer.

Newport, Mon., *November 27th.*

Emergency Lighting

Once again the failure of public electric lighting supply in a public place has jeopardised the safety of human life. During a recent "black-out" in a Cardiff circus, a trainer was unable to locate a missing lion (one of five) in the arena. Fortunately, the audience thought it part of the performance and a panic was averted. The trainer *knew* the danger.

One day a calamity will stimulate the authorities to insist that in every situation where the failure of public electricity supply is likely to endanger human safety (such as in hospitals, theatres and similar places) an emergency installation shall be installed that will *automatically* operate in the event of breakdown of public supply. The public will then feel more safe. ALFRED WARBIS.

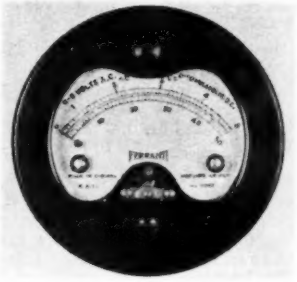
Martock, Somerset, *November 27th.*

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

A New A.C./D.C. Instrument

MESSRS. FERRANTI, LTD., have recently increased their range of 2½-in. instruments by the addition of a 2½-in. dial moving-coil flush-pattern model for a.c. and d.c. use. With this apparatus a.c. and d.c. readings can be made at choice by the operation of a switch on top of the instrument, the a.c. readings being obtained by means of the use of a small copper-oxide rectifier fitted in the case.



The new "Ferranti" instrument

The full scale readings are 5 V a.c. and 50 mV d.c. Both these ranges have a resistance of 1,000 ohms per volt, giving additional ranges of 0-1 mA a.c. and 0-1 mA d.c. From these four ranges any number of a.c. and d.c. ranges can be obtained by the use of suitable external shunts and resistances. In this way, the instrument is invaluable to the experimenter who wishes to have a fundamental instrument to which he can apply his own external multipliers for any desired reading.

A Screwless Lampholder

A lampholder of the bayonet type with positive cord grip that obviates the need for small screws is being put on the market by the NUWAY ELECTRICAL ACCESSORIES CO., 224, Fulham Palace Road, Hammersmith, W.6. Substantial phosphor-bronze springs provide the pressure for the plungers, which are always in contact with their sockets, thus relieving the springs of the duty of carrying current. The upper ends of the spring sockets are held in position by small locking rings and at the other ends by bakelite flanges. The flex is threaded into the holder through bakelite cones which are pressed into the sockets; a dividing bridge takes the strain off the cones and prevents short-circuit.

The "Nuway" lampholder

The retail price of these holders is 7½d. each, or with Home Office shield 9½d., packed in three dozen lots in corrugated partition boxes. Other types are under development. A brown colour has been adopted as standard, but walnut or black can be supplied at the same price; for other colours a small additional charge is made. By the use of pin terminals pressed into the flex as it comes through the bakelite cone, and bedding into the spring socket, lamps can be made self-locking for use in institutions, hotels, &c.

New Type of "E.M.B." Resistance

THE ELECTRO-MECHANICAL BRAKE CO., LTD. (now the E.M.B. Co., Ltd.), West Bromwich, claims to have originated the unbreakable jointless and rustless grid-type resistance. The demand for this type of resistance has steadily increased, and now a new type of light-weight unbreakable resistance has recently been introduced and is being used in the new fleet of fifty-six trolley-buses now on order for Nottingham Corporation.

Trolley-bus service often represents arduous service for resistances, for they are subject to considerable vibration and at times may even be choked up solid with snow, but even under these conditions it is claimed that the new "E.M.B." strip-type jointless and rustless grid-type resistance will not fail. The difficulty of combining light weight with strength has been overcome by using strip material and flanging the edges between the loops. An exceptional rigidity is thereby given to the grids which require very little support from the mounting bars even when under severe vibration. The strip construction also ensures a large radiating surface for rapid heat dissipation.

The grids are mounted on steel rods insulated by special heat-resisting micanite tubes covered with a thin layer of bakelite to prevent flaking. Washers of natural mica separate the grids, and special end spacers are provided to give large creeping distances. Where excessive heating occurs, or where mica insulation is not allowed, the resistance can also be supplied with interlocking steatite insulators instead of the usual mica washers.

Another noteworthy feature is the terminal fixing arrangement which ensures that ample and intimate contact is made with the grid. A sherardised tee bolt, passing through the grid loop hole, forms the means of clamping the copper strip stirrup and the copper pad to the grid. The flat face of the copper pad enables a good connection to be made with the terminal block or connecting link, while the ends of the copper stirrup are forked to clear the mounting washers, so that adjustments may be made without disturbing the mounting rods. Holes are pierced in each loop so that it is quite a simple matter to re-insert the tee bolt in a new position when an adjustment in grading is necessary. There is no local heating, owing to the good radiation and ventilation.

The terminal itself consists of a brass pressing of substantial section, provided with a large cable hole. The cable is secured by a hexagon headed bolt of ample size fitted with lock nut. When desired, a terminal bar can be mounted at the base of the resistance. The standard ventilating covers are of small mesh expanded metal reinforced with a wide beading of steel strip at the edges, and weatherproof louvred covers with or without baffle plates can be supplied to suit any particular requirements.

The new "E.M.B." resistance; and (right) the terminal fixing arrangement

The Universal "Avometer"

We have recently examined a new universal "Avometer" made by the AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO., LTD. This gives thirty-four ranges, a.c. and d.c., on a 5-in. scale, without the use of external shunts, multipliers, or transformers. The improved frequency characteristics are B.S. first grade from 25 to 100 cycles and within 5 per cent. at 5,000 cycles. The total resistance of the instrument is 200,000 ohms.

The universal "Avometer"

The following d.c. ranges are available: Current, from 0 to 6 mA, 12 mA, 60 mA, 120 mA, 600 mA, 1.2 A, 6 A and 12 A. Voltage from 0 to 60 mV, 120 mV, 600 mV, 1.2 V, 6 V, 12 V, 60 V, 120 V, 600 V and 1,200 V. Resistance, from 0 to 1,000, 10,000, 100,000, or 1,000,000 ohms (the high values on each range of the resistance reading may be doubled when desired). On a.c. the following ranges can be measured: Current—from 0-60 mA upwards as on d.c.; voltage—from 0-6 V upwards as on d.c.

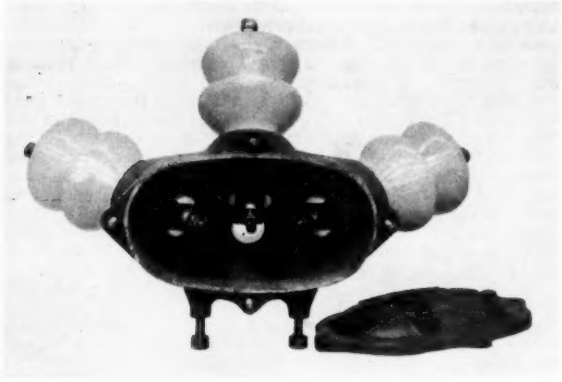
An Improved Trifurcating Box

In close collaboration with operating and distributing engineers, MESSRS. ERSKINE, HEAP & CO., LTD., Caroline Street, Manchester, have produced an 11,000-V inverted pole-mounting trifurcating box with a number of novel features.

Exceptionally wide clearance—14 in.—is provided between phases and from live parts to earth, while, in the event of a flash-over, the wide spacing of the terminal insulators enables the ionised gases to get away quickly. Cement is not needed to secure the terminal rods and insulators, as a special internal clamping device is incorporated, thus ensuring flexibility under varying degrees of atmospheric conditions, and it is of such design as to prevent weeping at the joints. The lay-out of the cast-iron body requires a minimum volume of compound and no plumbing is required on the cable gland. Its comparatively light weight makes it easy to erect, and the box has withstood safely a wet test of 90 kV between

phases and 45 kV to earth for fifteen minutes without any indication of failure.

The easy-fitting cover is secured by four nuts only, and connecting jumpers may be taken with ease and safety in

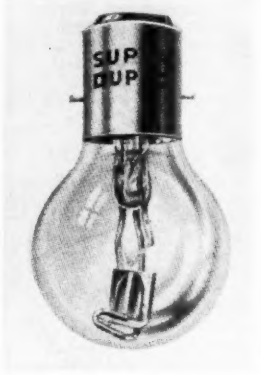


The Erskine Heap trifurcating box (plan view)

any direction, while the box is suitable for three-core cables up to 0.075 sq. in. These boxes are already in use on the Torquay Corporation's system.

A Shockproof Head Lamp

One of the first Philips contributions towards safer night driving was the "Duplo" head lamp with two filaments. The first provided a powerful beam for normal use, whilst the second, being partially enclosed in a metal cup, directed its light towards the upper part of the reflector. The light could thus be "dipped" and did not blind the oncoming traffic whilst allowing the driver a safe margin of light on the road, but it is extremely difficult to make bulbs of such intricate construction to stand up against the violent jolts and vibrations to which they are subject on the modern motor vehicle. It is because of this that PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2, have introduced a new bulb—the "Super Duplo."

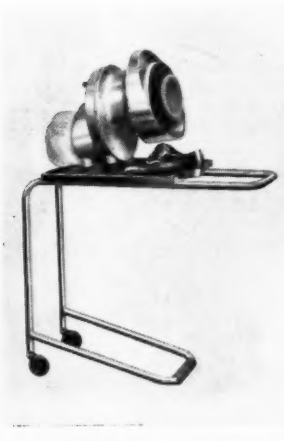


The "Super Duplo" lamp

This bulb still embodies the twin filament feature of the ordinary "Duplo," but has been reconstructed and incorporates a "built-in" shock absorber. The efficiency of this internal shock absorber has been demonstrated by special tests with a shock apparatus. After receiving only one shock an ordinary motor bulb was found to be unfit for use, whilst the "Super Duplo" withstood a hundred exactly similar shocks and still functioned normally.

An Electric Shoe-cleaner

A great deal of time is occupied in hotels in cleaning shoes, and when the shoes have been very dirty the results often leave a great deal to be desired. An ingenious electrically driven device has been put on the market by TAYNOR MACHINES, LTD., 29, Store Street, London, W.C.1, which will clean and polish footwear rapidly and efficiently. The shoe to be cleaned is held in position against a hollow cylindrical rotating brush which quickly removes all dirt and dust from the heel, toe and sides of the shoe. An exhaust fan draws the dirt and dust into a bag provided, a process which also keeps the brush clean, so that it can be utilised for both black and brown shoes; however, separate brushes may be used, as they are easily interchangeable. The soft polisher fitted inside the brush is flexible and will polish the whole surface of the toe or heel in one operation, giving a pleasing "patent" finish to the shoe. Paste or cream is only necessary every few days as a dressing for the leather, and for this purpose a self-feeding applier is provided in which the paste is kept moist and ready for use.

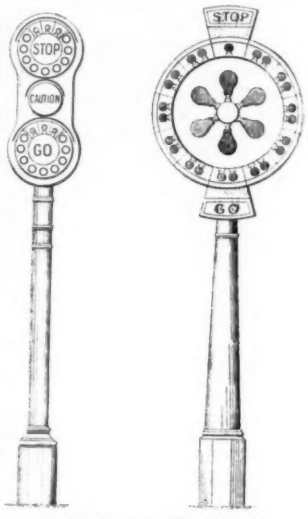


The "TayNor" shoe-cleaner mounted on a stand

Lubrication is automatic, a few drops of sewing-machine oil being necessary about every six months. Should excessive pressure be applied to the brush the machine will automatically stop until the pressure is released; in this way damage to delicate shoes is rendered impossible. The specification is briefly as follows: Length, 18 in.; width, 12¾ in.; height, 15½ in.; loading of motor, 125 W; price, £14 10s. A stand 2 ft. 4 in. high and priced at £4 10s. is available to convert the machine into a portable model for cleaning shoes outside bedroom doors. As the machine runs very quietly, this may be done during the night.

"Melvin" Traffic Signals

A new design of traffic signal known as the "clock-light" signal has just been introduced by MESSRS. MELVIN BROS., LTD., West Nicolson Street, Edinburgh. One type can be adapted to present signals. In this case a series of small lamps are arranged, as on a clock face, around the casing of the main signals. When the red light is showing, the twelve smaller lamps commence to light up one after another, showing red from the "one-o-clock" position, working round to "twelve-o-clock," when the main light changes to green, and the sequence repeats itself in green.



"Melvin" traffic signals

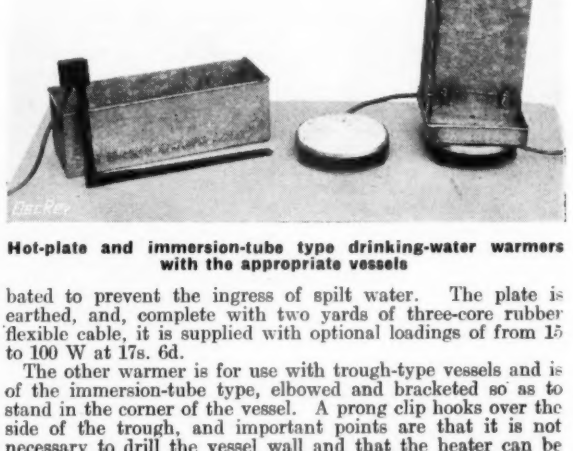
In another form this device is applied to a single dial which can be illuminated red, amber or green, at will. Around this dial are arranged the smaller lamps which glow successively for "a round of the clock" in a colour corresponding to that of the main dial. The accompanying diagrams show the two types of signal which are on the market.

Soil-heating Cables

Soil-heating cables specially manufactured to comply with the requirements of electro-horticulturists are being supplied by MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Holborn Viaduct, E.C.1. The non-inflammable insulation withstands high temperatures and the semi-flexible sheathing is of lead alloy. The cable is taped and thoroughly compounded to protect the sheathing from the corrosive action of soil and manures. Cables are supplied in lengths of 50 feet, loaded at 500, 750 or 1,000 W as required. Special boxes for connections between the mains and the cables are also obtainable.

Warm Drinking Water for Chickens

The warming of chickens' drinking water is claimed to increase egg production in cold weather, and because of this and to eliminate trouble with frozen water vessels CURFEW ELECTRIC HEATERS, Curfew Poultry Farm, Chertsey, have introduced two forms of drinking-water warmers. One is a low-loading "hot-plate" on which the vessel stands and it has elements clamped between a heavy cast-aluminium top and a strong cast-iron base. The joint between the castings is rebated to prevent the ingress of spilt water. The plate is earthed, and, complete with two yards of three-core rubber flexible cable, it is supplied with optional loadings of from 15 to 100 W at 17s. 6d.



Hot-plate and immersion-tube type drinking-water warmers with the appropriate vessels

The other warmer is for use with trough-type vessels and is of the immersion-tube type, elbowed and bracketed so as to stand in the corner of the vessel. A prong clip hooks over the side of the trough, and important points are that it is not necessary to drill the vessel wall and that the heater can be removed when it is not in use. It is supplied with loadings from 15 W upward and costs 7s. 6d.

Remember Your Windows! By A. Curwen

Suggestions for the Christmas season

TO-DAY is the first day of December, the month in which money is spent more freely than is the wont. It is the salesman's golden opportunity, and everyone in the retail trade knows it, and they use all the sales aids they have in an effort to get as great a proportion of the business as they can. We, in the electrical industry, whether we are very humble contractors with the smallest of showrooms, or the largest supply undertaking with the most magnificent showrooms, are retailers—we have goods to sell. What is more important, the goods we sell are advertising agents, and potential users of the commodity through which we gain our livelihood—electricity. Every iron sold means more business either to the contractor who is asked to wire up a point for the iron or to the supply undertaking which gains the increased consumption—usually at the lighting rate. Therefore anything calculated to help the sale of domestic appliances is bound to act in a beneficial manner to all in the electrical industry.

However, all this has been gone over time and time again, my object is merely to stress the point that this is a more favourable opportunity than we have ever had before. The world-wide depression is lifting, the grid is almost complete, electricity is becoming cheaper, assisted-wiring schemes, &c., have resulted in thousands more consumers being connected, the new advertisements of E.D.A. are having the desired effect, supply undertakings are advertising more than they have ever done before, the Press on the whole is favourably disposed to electricity—witness the recent articles and special supplements—and finally the community at large is getting more electrically minded every day.

Let us then make the most of the situation. To do this we must present our goods in the most effective manner; our showrooms must be inviting and well laid out, while the general atmosphere must be like the commodity with which we deal—brimful of the modern way of doing things, clean, healthy, bright, cheerful, quick, at the touch of a switch. But first of all we must attract the consumers—we must bring them in.

While the general public may not necessarily judge a sausage by its skin, they judge a shop by its windows. Therefore windows must attract, must interest, must arouse desire. I therefore offer the following practical suggestions—practical inasmuch as they have been carried out with success—in the hope that they will prove of great assistance to all retailers of electrical appliances who wish to dress their windows in an effective and selling manner.

Arousing Initial Interest

No matter whether the window space is large or small there are certain basic and fundamental principles which definitely apply to every case. Anything unusual—movement, light, effective backgrounds, &c., will attract attention, but by far the most effective is movement. It will be noticed that this is a thing usually lacking in most shops—but it is undoubtedly the finest method of drawing the crowds. A turntable, a flashing sign, a "flicker" fire, coloured lighting, changing lighting, or even a hidden fan blowing the Christmas tree, or decorations. However, this movement must be linked up with the display. A toy train careering round a window would attract attention, but it would not necessarily create sales, but a toy motor car could be made to remind people of their cars this winter and indicate the value of a car warmer. A doll, or if possible a wax figure in bed in a window, would attract attention without movement and could be linked up with electric blankets.

To arouse interest windows must be timely and topical. Remember the customer will be asking herself—"Is it what I want?" You must show her that it is. First of all it is Christmas—your windows must indicate this—a Christmas tree is symbolical, therefore use one. It is a time for giving presents—indicate them, draw attention to them, and "dramatise" them if your window space permits; if it doesn't, have cards telling the story. Suggest for whom they are suitable and how they can be used; indicate their useful nature, for people like useful gifts. Display the gifts against an effective background. A background increases visibility and shows up the goods. People don't wish to see inside your shop from the outside—anyway if they can there is nothing to go in for. If they can see all your stock, and there is nothing more to see, they will probably go on to some other store where they will be lured inside by inviting windows and sold to by enterprising salesmen.

The background must be a suitable one, regard being paid to the colour, size, and general nature of the appliances. Backgrounds can be made quite easily and cheaply out of very stout cardboard, three-ply wood, corrugated metal, varnished corrugated cardboard, Essex boards, or draped cloth. Crêpe paper backgrounds can be made to look very effective, though I consider that it is not as effective as the other media mentioned. Mirrors can be used in a background to create an illusion of space, though they unfortunately have the drawback of reflecting the more prosaic elements of display—lighting units and rear portions of fittings, as well as passing traffic.

Colours should be used in conjunction with the lighting, consideration being given to the light-absorbing qualities of the colours. Beware of your favourite colour, and do not over-emphasise one particular hue. At this time of the year dark green (holly and mistletoe), red (holly berries), white (snow), and crimson (warmth), are very suitable backgrounds, especially as electrical gifts have usually a nickel finish—red being a most appropriate background for silver. The colours of price tickets should be in harmony with the general colour scheme. Another point is that colour can be used to balance a window—a bunch of holly to balance with green, and so on.

Effective Price Tickets

Desire to possess can best be stimulated by small cards bearing sales talk appealing to purchasing motives. The safe rule in salesmanship is: Sell on quality whenever it can be done; only sell on price when quality is lacking. The window cards should indicate the sales points of the appliances to which they relate. The maker's name and the price are totally insufficient. The ticket might state for example—"This radiator is specially designed to give the maximum amount of radiant heat for the lowest possible consumption of electricity. Nevertheless it is portable, and light, and is capable of heating a room A×B ft. at a cost of xd. per hour yy/-." The example is probably a little longer than is necessary but I trust that it indicates the point. Another method of stimulating desire is to "dramatise" the goods—show toast (perfectly toasted) in the toaster, use a tie when showing a tie ironer, and have the clocks going, imitation coal fires flickering, and so on.

The well-dressed shop-window is an advertisement of the showrooms, but it has a big advantage over the usual run of advertisements. The reader of poster or newspaper advertisement cannot buy the goods advertised at the moment; and she will probably forget all about them. With the window display, however, the customer sees the goods, and if the shop is open she can purchase the goods right away. It shows the actual goods, too, which is far better than any picture can be. It amazes me that whereas a supply undertaking will spend on an average £10 per week on newspaper advertising it will not spend a ha'penny on window display. People will buy what they see far more than what they read about.

Now with the customer outside your window you must invite her in. Therefore use invitation cards in the window announcing further displays inside the shop; if there is a cooking demonstration on and tea is being served, ask the passers by to come in and have a cup. If you have a large Christmas tree effectively lighted and dressed, invite customers to bring their children in to see the tree, state that they will not be pressed to purchase, make your windows inviting—you will bring them in if only you try. Of course the foregoing only illustrates fundamental principles—now for real suggestions.

The window displays arranged by E.D.A. are fairly suitable for the small contractor with only one window, and very little window space at that, but I would suggest a little movement, if it is only a revolving turntable in the centre, and colour lighting to give tone to the setting. Cards bearing selling points should also be used. E.D.A. displays are notorious for their lack of originality in the wording used with the displays —"Give Electric Gifts" is terribly dead. Much better to state why one should "give electric gifts." However, an E.D.A. background is usually fairly effective for a small window, but the invitation cards should not be forgotten.

For Larger Showrooms

We now come to the contractor with two windows, or the supply undertaking's showroom with several windows. I will presume that the entrance is in the middle of the main fronts. One half of the showroom should be thrown as much open as possible—that is the window should be given as much depth as space will permit. The background should be covered in wall paper suitable for a lounge, winter being suggested in a suitable manner by a frosted glass imitation window across which curtains should be drawn. Around the top of the background the usual paper festoons, &c., would appear. Arrangements could be made with a local furnishing house to lend the necessary furniture suitable for a lounge, acknowledgment being made by means of a small card in the window. In the

centre a large Christmas tree could be placed complete with tub, and decorated with the usual electric Christmas tree sets. Numerous electrical gifts could then be hung on the tree, complete with labels stating who they are from and to whom they are given. In the fireplace would be a large imitation coal fire (on, of course) bearing a label "From Dad to the Family." At the foot of the tree could be a vacuum cleaner, "From Dad to his New Daughter-in-law," and so on. It can be remembered that all sorts of electrical gifts can be shown for most families gather together at Christmas. Streamers would, of course, be stretched across the top of the window, and standard lamps, both floor and table, could be shown as furnishings and as gifts. A large card could then be placed in the front of the window bearing the inscription "All ready for Christmas Morning—Are You?" Other cards would then draw attention to the opposite window where numerous gifts would be displayed, and inviting passers-by to come inside and look around. Along the window bottom suitable presents could also be shown.

The other window could then be divided up into price ranges, such as gifts under 10s., between 10s. and £1, between £1 and 30s. Sales cards should be used as much as possible, and, in contrast to the other window where shadow should play its part, this window should be brilliantly lighted, though not to dazzle; daylight lamps would probably prove the most effective, as they throw up the nickel and chromium finishes very well. Here a turntable should be introduced as an eye-catcher, and if daylight lamps are used a blue background introduced; failing that a red background with plenty of light would be suitable. All appliances should, of course, be highly polished, and tastefully displayed. If space permits fires should be displayed in another window. These are merely suggestions and the individuals concerned must use their own ingenuity to a great extent. My main object is to stress the attraction of the "scenic" window, when linked up with the selling window, and to emphasise the fact that a scenic display alone is inadequate.

In conclusion, I would remind the reader that electric light is definitely a sales aid. Therefore the more it is used and the more effectively it is used, by means of colour screens, &c., the better electricity is advertised. The electricity showroom should always be the most effectively lighted shop.

Lancashire Power Developments

THE opening of the new showrooms in Ormskirk represents another step in the Lancashire Electric Power Co.'s programme of intensified developments in small towns and rural areas. The Ormskirk Electric Supply Co., Ltd., became associated with the Lancashire Electric Power Co. in 1929, and since that date rapid progress has been made

The new showrooms at Ormskirk

in raising the number of consumers in the town itself to about 900 out of approximately 2,600 households. The new showrooms will not merely serve Ormskirk but many L.E.P. consumers in surrounding districts including Burscough, Bretherton, Skelmersdale, Parbold, Croston, Bickerstaffe, &c. The way for the new showrooms was paved by energetic sales work, supported by exhibitions held in most of the townships mentioned and aided by newspaper and cinema slide publicity.

The showrooms comprise an extension of the old sub-station and office premises at Park Road. The slogan "Use More Electricity" in orange neon runs across the front of the showroom with an arrow pointing to the entrance porch. The upper part of the building is outlined in blue neon. The porch is an attractive feature of the premises. It has been designed so that on entering an excellent view is obtained of the heating chamber and of the thermal storage system supplied by Messrs. Crittall & Co., Ltd., by means of which the whole of the premises are warmed.

In the layout of the showrooms special provision has been made for cooking demonstrations, while a bathroom exhibit displaying electric water heaters of different types is a prominent feature. The pay desk screen is so situated that consumers inevitably obtain a good view of appliances when settling accounts. The walls and pay desk screen are of panelled mahogany; pilaster columns and door panels are of tinted opal glass with ornamental lighting. A central glazed column and glazed display table built around it incorporate coloured lighting that can be changed at will to suit any scheme of decoration.

Among other things, the possibilities of shop-window, showcase, concealed strip and coloured lighting are all effectively demonstrated. Fixtures are secured to removable mahogany battens, worked into the design of the walls, but easily detachable so the whole place can be rearranged and any particular display of domestic, or even farming or small industrial apparatus arranged without difficulty.

Electricity on the Farm

Within the past three years electricity has made increasingly rapid progress on farms of all classes in the area. Poultry is of considerable importance and the use of electric incubation, brooding and lighting is extending quickly. Pig-breeders also are showing a new interest in electricity for the lighting and warming of styes. The application of electricity to the driving of all types of machinery including milking, grinding, mixing, milk cooling, and cream separating is being readily taken advantage of. For can-scalding and bottle-washing electric hot water systems are in demand. In the farmhouse the advantages of electric cookers and other appliances seem more highly valued than in some towns. Although farming activities are thought of first when considering the area, industrial enterprise is by no means absent and small businesses are turning more and more to electric power.

For many years the stalls in the Ormskirk market had been dependent upon high pressure paraffin lamps. The Urban District Council decided to electrify the stall lighting in conjunction with the new street electric lighting scheme required in the market place. As the market is only open on Thursdays and Saturdays the primary requirement, after safety and good illumination, is facilities for quickly disconnecting the lighting on the stalls, which have to be cleared away rapidly under local bylaws. A scheme was worked out and approved whereby each stall is provided with removable battens on which the lampholders are fitted. In the street-lighting standards control arrangements are incorporated which govern both the stall and street lighting. When the stalls are dismantled there is nothing unsightly remaining.

The Bretherton sub-station

An outstanding development of recent months in Ormskirk was the opening of the £200,000 training college for women teachers to replace the old college at Edge Hill. Full advantage has been taken of electrical service in equipping the college; the cooking for some 250 residents is done by electric ovens supplied by the General Electric Co., Ltd.

The sub-station adjoining the showrooms provides all the necessary equipment for distribution over the whole of the Ormskirk, Latham, Burscough, Skelmersdale, Bickerstaffe, and Parbold districts. In distributing in the outlying rural areas every effort has been made to keep the sub-stations in harmony with their surroundings. The sub-station at Bretherton is in selected rustic brick with brick-red tiled roof. The garden is tastefully laid out and planted with apple trees to give a finishing touch to the appropriate rural atmosphere.

In the Courts

IN the King's Bench Division last week Mr. Justice Branson continued the hearing of the action brought by Vulcan Foundry, Ltd., against Associated Electrical Industries, Ltd., to recover the balance of the price of the mechanical parts of thirty-one sets of electric freight locomotives for use on the Great Indian Peninsula Railway. On that head the plaintiffs claimed £36,584 and a further sum of £1,586 for spare parts for the locomotives.

The dispute arose out of a contract made in January, 1927, between the Metropolitan-Vickers Electrical Co., the defendants' predecessors, with the High Commissioner for India for the supply of forty-one locomotives. The question was whether the plaintiffs agreed to make the mechanical parts of the locomotives for a reasonable price, no price having been fixed. The terms of the contract had not been reduced to writing, and it was therefore necessary to ascertain them from the evidence of what had happened. The defendants by their defence denied the construction which the plaintiffs put on the contract setting up nine alternatives to such a contract and pleading a couple of estoppels. His Lordship was only asked to decide the question of law which arose on the contract.

Sir Leslie Scott, K.C., having occupied four days in opening the plaintiffs' case, Mr. Frederick S. Whalley, the managing director of the plaintiff company, gave detailed evidence as to the alleged agreement which the company made for the supply of the mechanical parts of the locomotives and as to the drawings which from time to time were submitted to the plaintiffs for approval. In cross-examination by Mr. Singleton, K.C., who represented the defendants, the witness said it was thought from the outset that their prices for the parts would be incorporated in the tender of the Metropolitan-Vickers Electrical Co.

On Tuesday last Mr. Whalley was re-examined, and the hearing was again adjourned until yesterday (Thursday).

The Definition of "Sterling"

On November 23rd the House of Lords, consisting of Lords Atkin, Warrington of Clyffe, Tomlin, Russell of Killowen, and Wright, continued the hearing of the appeal by Mr. Josiah Feist from the judgment of the Court of Appeal affirming the judgment of Mr. Justice Farwell in the Chancery Division holding that Mr. Feist, as the holder of a £100 bond issued by the Société Intercommunale Belge d'Electricité in September, 1928, was not entitled to have repayment of the monies secured by his bond in bullion or gold, but that the debt could be discharged by payment in bank notes or what was legal tender in this country.

The bond in question was part of a series of bonds issued by the company in 1928 in England, and each bond provided for payment of £100 on September 1st, 1963, or such earlier day as the principal moneys thereby secured became payable. The endorsed conditions provided that the principal moneys and interest thereon should be repayable in "sterling in gold coin of the United Kingdom of or equal to the standard of weight and fineness existing on the last day of September, 1929." The conditions also provided that the bond should be construed and the rights of the parties regulated according to the law of England.

Mr. Gavin Simonds, K.C., for the respondents, continuing his address, said that the single question was what was meant by the words by which the respondents agreed to pay the sum of £100 in sterling in gold coin. His submission was that it was an agreement to pay a sum of money in English currency. He wanted to get away from the suggestion that it was a bullion or a commodity contract. He asked their Lordships to say that respondents could discharge their obligation by tendering bank-notes.

On November 24th Sir William Jowitt, K.C., replied on behalf of the appellant, and their Lordships reserved judgment.

The Nigerian Electricity Supply Corporation's Losses

In the Chancery Division on November 28th Mr. Justice Luxmoore had before him a petition for the reduction of the capital of the Nigerian Electricity Supply Corporation, Ltd., from £650,000 to £500,000. Mr. Reed for the company stated that its capital was divided into 450,000 preferred ordinary shares and 200,000 ordinary shares, all of which were issued and fully paid. Capital to the extent of £150,000 had been lost or was unrepresented by available assets, and the loss would primarily fall on the ordinary shares, which were to be reduced from £1 to 5s.

The evidence of the loss was contained in an affidavit by Mr. E. S. Marks, managing director of the company, who said that the company was formed to provide electrical power to some of the principal companies engaged in tin mining on the Bauchi Plateau in Northern Nigeria where there existed large alluvial tin fields. The company acquired a Government concession of land and water rights and between February, 1929, and February, 1933, expended £418,389 in the construction of a 12,000-h.p. hydro-electric plant on the Kurra Falls. It also constructed a reservoir with a storage capacity of 400 million gallons of water.

In April, 1929, agreements were entered into with six of the principal tin producing companies to supply them with water. Subsequently there was a drastic fall in the price of tin and three of the tin mining companies went into liquidation in 1930 and had been unable to fulfil their contracts with the petitioning company, and they had been compelled to grant rebates to the other companies. This had seriously reduced the value of the petitioners' concession and plant.

The company was disposing of less than 3,000 h.p. and three-fourths of the plant and equipment was out of service. The plant cost £146,000 more than was estimated, and in addition to this a flood swept away the original spillway, necessitating the construction of a new one.

In the result his Lordship said the loss had been proved and he confirmed the reduction.

New Books

Conjugate Functions for Engineers. By MILES WALKER. London: Oxford University Press. Price 12s. 6d.

In this little treatise Dr. Miles Walker deals with the application of conjugate functions to the solution of problems in electricity and magnetism which involve two-dimensional fields of force and flux. The opening chapter is of an introductory character, and in this the author examines in detail some simple functions of a complex variable, and goes on to explain the origin of the Schwarz-Christoffel transformation. Having developed the general theory, the author proceeds to the applications of this theory to various problems on the flow of current in conductors of various forms, and on the disposition of the magnetic flux in the slots and air gaps of dynamos.

Dr. Walker has evidently been at considerable pains to make his subject clear and intelligible to the reader of modest mathematical attainments, and an important and meritorious feature of the book is the detailed calculations for the numerical evaluation of the analytical results given by the theory. The appeal of the book is, however, essentially to the specialist, and to such readers it will be of considerable interest. Apart from its technical interest, the work is a real contribution to the literature of applied mathematics.

Vectors for Electrical Engineers. By E. MALLETT. Pp. 181; figs. 115. London: Chapman & Hall. Price 13s. 6d.

The fact that the symbolic vector notation has been used to a much lesser degree in this country than in America is probably accounted for by the fact that no English author has dealt with the subject with the clearness and thoroughness which characterised the writings of Steinmetz. If the need for a book dealing comprehensively with vectors exists, that need will certainly be well met by this work.

The opening chapter is a concise but full account of the general theory of vector algebra, while the bulk of the book applies this theory to the calculation of a.c. circuits and bridge networks, to three-phase circuits, and to alternators, a.c. motors, and transformers. A conscientious study of this book will not only give the student a firm grasp of the application of complex quantities to a.c. calculations but will teach him both the potency and the limitations of this method of procedure. A short account of the hyperbolic functions, with, perhaps, an explanation of their derivation from the rectangular hyperbola, would have made the preliminary chapter more complete, and would have been useful to the beginner of limited mathematical knowledge. In the chapter on three-phase circuits one would have liked to see some account of the three-phase complex operator and its application to the theory of symmetrical components. The cumbersome derivation of the well-known formula for finding three-phase power factor in balanced circuits might well have been omitted in a work of this character.

Finally, while it is pleasing to be able to note that numerous examples with answers have been provided for the benefit of the student, it is to be regretted that the author has given no worked examples in the text.

Classified Examples in Electrical Engineering. Vol. I—Direct Current. Pp. 83. By S. G. MONK. London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d.

This manual is doubtless known to most teachers, and, judging from the fact that it has reached its third edition, to many students. There can be no two opinions as to the educational value of numerical examples to be worked out either in class or as home exercise.

The questions are largely numerical—we should like to say "all"—for questions inviting opinions and vague comparisons from beginners are inclined to be fatuous and wasteful of time and energy. A wide range is covered—Ohm's law to questions on machines and traction; indeed, practically every aspect of d.c. working is included, except distribution. Some of the sections are prefaced by notes and worked-out examples, but too much in this direction must not be expected in a book of eighty-three pages. In this new edition a number of questions have been added, chiefly of the more advanced type, and these have increased the usefulness of the book considerably.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

Manufacturers and the Merchandise Marks Act

In a questionnaire addressed by the National Union of Manufacturers to manufacturers' trade associations and to its members, regarding the desirability of reversing the operation of the Merchandise Marks Act, the opinion is expressed that all foreign goods on importation into this country should be marked unless a sufficiently strong case for exemption, to the satisfaction of a statutory committee, can be made out by the importer.

A Ferranti Production Recorder

The accompanying illustration shows a device installed in the office of Mr. D. Z. Ferranti which has been produced by Messrs. Ferranti, Ltd., to enable a continual visual check to be kept on production. The apparatus is actuated by means of photo-electric cells arranged in such a manner as to count the number of articles produced, and an indication appears

A production recorder installed in Mr. D. Z. de Ferranti's office

on a chart showing the output every ten minutes. In addition, a cyclometer counting mechanism is included, which gives the aggregate number of articles produced over a given length of time. Synchronous electric clocks are employed throughout the factory, and one of these clocks is incorporated in the gear, for precise time-keeping.

Recent Contracts

Messrs. Veritys, Ltd., announce that they have secured the contract for the lighting fittings for the L.M.S. Railway Co.'s new offices in Seymour Place. Approximately 900 " Maxlume " enclosed units for 150-W lamps are being supplied finished in toned bronze and complete with diffusing glassware, to British Standard Specification as regards transmission and diffusion.

The Alton Battery Co., Ltd., has, amongst numerous orders in hand, the complete replating of two 600-Ah batteries at West Hartlepool telephone exchange, and two 900-Ah batteries at Dudley automatic exchange. Renewal elements are being supplied for the telephone exchanges at Llanelly and Cradley Heath, and a 300-Ah battery for installation in St. David's Cathedral, Pembrokeshire, is in hand. Export contracts include two 1,400-Ah and twelve 300-Ah batteries for the Union of South Africa Post Office and a 120-cell battery for Northern Rhodesia.

Messrs. Marryat & Scott, Ltd., have received the contract to carry out the whole of the lift installation for the London Passenger Transport Board at Leicester Square sub-station.

Messrs. C. A. Parsons & Co., Ltd., have received an order for a turbo-compressor capable of delivering 900,000 cu. ft. of gas per hour at a pressure of 154 lb. per sq. in. absolute. The compressor will run at a speed of 5,670 r.p.m., and will be driven through step-up gearing from a steam turbine running at 3,300 r.p.m.

In 1927 eight Babcock & Wilcox boilers were installed in the Kearsley power station of the Lancashire Electric Power Co., each for an evaporation of 75,000 lb. of steam per hour at 305 lb. per sq. in. and 700 deg. F. final temperature. It has recently become necessary to increase the evaporation of each unit to a normal load of 95,000 lb. of steam per hour, and in July Messrs. Babcock & Wilcox, Ltd., received an order for a Bailey water-cooled furnace to permit this increase of load. This furnace has been in operation for some weeks, and the company has now received the order for Bailey furnaces for the remaining seven boilers.

The Electricity Supply Rifle League (London)

The Electricity Supply Rifle League (London) held its annual dinner and prize distribution on November 25th at Maison Lyons, Shaftesbury Avenue, W. Owing to the unavoidable absence through illness of the president, Mr. G. C. Weston (Kensington & Knightsbridge Co.), the chair was occupied by Mr. H. P. Gaze (London Power Co.), a past-president. He was supported by Messrs. W. Weekes (borough electrical engineer, Shoreditch), S. C. Nodes (London Power Co.), A. R. Bacon (County of London Co.), and E. Harlow (City of London Co.). After the prize distribution, a presentation was made to Mr. Matthews, the League secretary, who has acted in this capacity since the inception of the League twenty-two years ago.

The Marking of Imported Radio Valves

The Board of Trade has announced that a draft Order in Council was laid before Parliament on November 22nd requiring imported radio valves and rectifying valves of the following descriptions to bear an indication of origin on sale or exposure for sale in the United Kingdom :—(a) Thermionic valves dissipating a dead loss at the anode not exceeding 500 W; (b) rectifying valves not exceeding a capacity of 60 VA or passing a current of more than one ampere. Under the Order the indication of origin must be durably marked in a contrasting colour on the bulb or cap of each valve, and also printed or stamped on any carton or other container in which the valve is sold or exposed for sale. Goods to which the Order applies shall bear the indication of origin on exposure for sale wholesale only if the person so exposing the goods is not a wholesale dealer. Nothing in the Order shall require any goods to which it applies to bear an indication of origin at the time of importation. The Order will come into force at the expiration of three months from the date thereof.

New Continental Lamp Factories

It is announced from Bucharest that the Petroschener Colliery Co. is making arrangements for the establishment in Lupeni of the first incandescent electric lamp works in Roumania. The machinery and plant will have to be obtained from abroad, and for this purpose exemption from import duties has been granted. In the case of Esthonia it is reported from Reval that ex-General Lebedew intends to erect a factory in that city for the assembly, provisionally at first, of lamps from foreign materials, although the individual components will subsequently be made in Estonia. As the existing import duty is considered to be insufficient protection, the promoter of the scheme has asked the Government to increase it. An average of 300,000 incandescent electric lamps per annum have been imported.

A Useful Radio Year-book

The tenth edition of the " *Wireless & Gramophone Trader* Year-Book and Diary for 1934," which has just been published, is in a much enlarged and revised form. The page size has been increased to over 11 in. by 8 in., and this should be particularly useful to those who use the diary section. The contents are in the same general sequence as in previous editions, and advantage has been taken of the increased page area to make the directory sections more easily readable at a glance. The white section has undergone a number of changes. New features include an up-to-date table of valve characteristics, a list of broadcasting stations, detailed explanatory articles on the patent position and the new " Pool " licence, a revised design for a dealer's power amplifier, and a dealer's test set. The Receiver Specification has been entirely rewritten, and all other features revised where desirable. The " Year-Book " is published by the Trader Publishing Co., Ltd., at 5s. 6d. post free (reduced price to subscribers to the " Trader " journals).

Irish Free State Electrical Imports

A more active tone again prevailed in the electrical trade in the Irish Free State during September last, the imports of electrical machinery, fittings, and cognate apparatus attaining a value of £65,557 as compared with £48,078 in September, 1932. The appended table gives details of the aggregate imports during the first nine months of the current year and shows an increase of £65,209, or over 13 per cent.

	January — September. 1932.	1933.
Electrical machinery	133,327	162,288
Electric wires and cables	86,074	45,102
Wireless sets and parts	108,965	138,426
Electric lighting accessories, fittings and parts	37,761	28,679
Other electrical goods	112,789	171,988
Copper wire	7,296	4,928
Total	£486,212	£551,411

Trade Announcements

The Electro-Mechanical Brake Co., Ltd., has abbreviated its name to " E.M.B. Co., Ltd." Since the formation of the company the scope of its manufactures has widened to such an extent that the name had become misleading.

C.C.A. (Central Cables & Accessories), Ltd., has been appointed by Electrical Appliances (Blackpool), Ltd., as sole London and Southern Counties agents for that company's manufactures, which include snap-plugs, interlocking switch-plugs, junction boxes, and bell transformers, in bakelite.

On December 4th the head office of the Edison Swan Electric Co., Ltd., will be transferred from Queen Victoria Street to 155, Charing Cross Road, W.C., where all communications should be addressed. (Telephone: Gerrard 8660.) Business at the trade counter, 228, Upper Thames Street, will be carried on as usual.

Italian Electrical Imports and Exports

The imports of electrical machinery, apparatus and cognate material into Italy during the seven months ended with July last attained a value of £1,059,400 as compared with £1,516,600 in the corresponding period of 1932. There was also a decline during the same period in the exports of similar material from Italy, from £1,044,450 to £410,617.

The imports of radio receiving sets and apparatus into Italy during the eight months ended with August last attained a value of £190.333 as compared with £210,483 in the corresponding eight months of 1932. There was a decline during the same period in the exports of similar material from Italy from £43,233 to £26,283.

French Electrical Imports and Exports

The French imports and exports of electrical machinery apparatus and goods during the six months ended with June last, as compared with the corresponding half of 1932, are shown in the appended tables.

Imports. Jan.-June.	1932. 1,000 fr.	1933. 1,000 fr.
Dynamo-electric machines and transformers	43,956	26,714
Telegraph, telephone and other electrical apparatus	121,465	88,504
Dynamo and motor parts	63	3
Incandescent lamps	37,830	37,942
Arc lamps and parts	171	103
Carbons for electrical and Industrial purposes	4,390	3,997
Electric wires and cables	4,317	30,232
Parts of electrical apparatus	8,824	7,941
Magnets, other than electro-magnets	671	715
Accumulators and parts	1,896	1,690
Dry batteries and condensers	5,260	8,844
Porcelain and other insulators	1,617	1,605
Total fr.	230,460,000	208,290,000
Total at 80 fr. to the £	£2,880,750	£2,603,625

Exports. Jan.-June.	1932. 1,000 fr.	1933. 1,000 fr.
Dynamo-electric machines and transformers	26,191	22,372
Telegraph, telephone and other electrical apparatus	46,512	42,483
Dynamo and motor parts	1,030	3
Incandescent lamps	10,001	9,850
Arc lamps and parts	373	108
Carbons for electrical and industrial purposes	8,450	6,353
Electric wires and cables	12,634	14,876
Parts of electrical apparatus	14,555	8,929
Magnets, other than electro-magnets	223	163
Accumulators and parts	6,700	7,611
Dry batteries and condensers	2,191	1,178
Porcelain and other insulators	5,553	8,094
Total fr.	134,413,000	122,020,000
Total at 80 fr. to the £	£1.680,160	£1,525,250

An Electric Iron Display Stand

The accompanying illustration shows a display stand which Premier Electric Heaters, Ltd., has designed for promoting the sales of its "Laundwell" electric irons. These stands, which are in blue and orange, are being distributed by the company to dealers in all parts of the country.

A "Premier" sales aid

Social Events

The annual dinner of the Southend-on-Sea Corporation Electricity Department was held on November 20th. In proposing the toast of "Our Undertaking," Coun. J. Le Masurier (chairman of the Electricity Committee), said that the sales of electricity as recently as four years ago amounted to 17,000,000 kWh, and for the year ended March 31st last the total was 25,000,000 kWh. This year they were going to advance by another three or four millions. Mr. A. C. Johnson, the borough electrical engineer, who presided, said that they were connecting new consumers at the rate of two thousand a year. The sales department was accounting for sales on the hire-purchase plan at the rate of £15,000 a year. In 1929, when he became engineer, he had laid down a scheme which was accepted by the Electricity Committee for the expenditure of a quarter of a million. That had been spent. He had since advised the Committee to reduce prices, and the charge per kWh instead of being 3d. was nearly 2d. That saving of 1d. per kWh on 25 million kWh meant £100,000 per year. They could not continue increasing their capital expenditure and reducing the charges unless there was a large increase in the sales of electricity. He suggested that the restrictions on the sales department should be removed.

The South Metropolitan Electric Light & Power Co., Ltd., held a successful dinner and entertainment on November 15th at Chiesman's Restaurant, Lewisham. Mr. W. J. Allbright, the local manager, supported by Mr. J. C. Dalton, manager and secretary of the County of London group, and Mr. A. R. Bacon, chairman of the Clesco Sports and Social Club, presided over a gathering of 228. Twenty "veterans" of over thirty years' service sat together, and the toast of the company was proposed by Mr. J. Staunton, who has forty-two years' continuous service to his credit. Much gratification was expressed at the recent decision of the Lewisham Borough Council to

Met-Vick players in an amusing scene

light seven miles of streets with the new "Osira" lamp. An excellent variety entertainment was arranged by Mr. A. Nicholls.

"Orders is Orders," by Anthony Armstrong and Ian Hay, described as a "military diversion," was presented by the Metropolitan-Vickers Dramatic and Operatic Society at the M.-V. Club, Stretford, on November 22nd, and the three succeeding evenings. The story of a film company's activities in a barracks offers some amusing situations, which were well acted in a realistic stage setting.

The Lewcos Staff Dramatic Society (the London Electric Wire Co. & Smiths, Ltd.) presented the farce "The Whole Town's Talking" by John Emerson and Anita Loos, at the Guildhall School of Music on Friday last. This Society gave its first presentation—a commendable effort—last year, and its latest performance indicates that it is rapidly settling down to become a strong company. Full advantage was taken of the many amusing situations which this play provides, and the ladies fully deserved the bouquets presented to them at the fall of the final curtain. It was pleasing to hear from Mr. E. Leete, the president of the Society, that those members for whom a part could not be found, gave of their best to make their colleagues' effort a success. The cast included Messrs. G. Sinclair, S. Graefe, E. Lockett, D. Smith, and S. Holt, and Mesdames G. Stoneham, D. Parker, P. Darby, I. Marston, M. Goodram, E. James, and L. House.

Messrs. Johnson & Phillips, Ltd., endeavour to foster goodwill and interest amongst their outdoor staff, many of whom are situated in outlying areas where there is little to amuse them in times when they are not at work. To this end, their controlling engineers at Westmorland have recently formed a football team, shown in the picture on page 783, and they have met such sides as Arnside Town, Carnforth Railway Athletic, Appleby Town, Milnthorpe and Staveley. Whist drives and dances are held by the Johnson & Phillips Social and Sports Club, Arnside, and an office is placed at the disposal of the club on Tuesdays and Fridays of each week for cards and other games.

Wages in the Cable-making Industry

The Joint Industrial Council for the Electrical Cable-making Industry announces that there will be no "cost-of-living" alteration in wages paid in the industry on the third pay-day in December.

Advertisement Corrections

The capacity of the Mayfair battery illustrated in the Alton Battery Co.'s advertisement in our last issue (Supplement page 35) is 13,000 Ah and not 1,300 Ah as stated.

In the advertisement of the Wardle Engineering Co., Ltd., in our last issue (Supplement page 40) two light-distribution curves were reproduced. The titles beneath these were inadvertently reversed.

The Hick Hargreaves Centenary

In our issue of November 10th we referred to the centenary celebrations of Messrs. Hick, Hargreaves & Co., Ltd. We have now received from the company a brochure outlining its history and illustrating some of its products during the past hundred years.

Prices of Materials

Messrs. F. Smith & Co. report, November 29th: No changes in the prices of copper (electrolytic) bars, sheets, wire rods and h.c. wire, and silicium bronze wire.

Messrs. James & Shakespeare report, November 29th: No change in the price of copper bars (best selected), sheet and rod. English pig lead, £13, 5s. increase.

Messrs. Edward Till & Co. report, November 29th: India-rubber, Para fine, 4⅜d., ⅛d. decrease.

New Showrooms at Peterborough

The new showrooms of the Peterborough Corporation Electricity Department were opened on November 24th. The exterior has a neon-lighted chromium facia, and the showrooms are designed to demonstrate the different methods of interior electric lighting. The basement contains a bathroom and kitchen electrically equipped, and in the latter weekly cooking demonstrations will be given. The bathroom includes water-heating apparatus, an electric fire specially designed for bathroom use, towel heaters, &c. The engineer and manager of the electricity undertaking is Mr. H. A. Nevill, who supervised the construction of the showrooms.

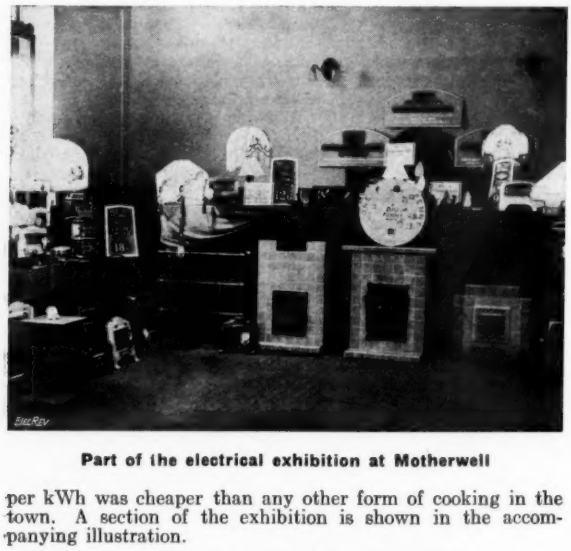
The B.B.C.'s Work

Of the fee of 10s. payable annually for each listener's licence the B.B.C. received in 1932 precisely 4s. 7d., the balance having been distributed among the Post Office (1s.), the Treasury (3s. 5⅛d.), income tax (5d.), and additional contribution to the Government's general revenue (6¼d.). Of its share the B.B.C. expended 2s. 6¼d. on programmes, 11¼d. on engineering, 7¼d. on standing charges, and 3½d. on administration, including ¼d. towards governors' fees.

In August, 1933, Lancashire's 5.0 9,097 population had 671,892 receiving licences and the 4,396,871 people in the London County area had 624,539. Yorkshire had 569,620, Essex 272,428, Middlesex 246,098, Warwickshire 229,469, Surrey 208,941, Kent 208,410, Scotland 394,097, Wales 186,023, and Northern Ireland 50 809. These are some of the figures revealed in the 480 pages of the "B.B.C. Year Book, 1934," including 100 pages of technical articles and 150 illustrations, which is published at 2s. Broadcasting House had 100 000 visitors in a year, and the number of schools registered as taking broadcast lessons in Great Britain was 4,000.

A Scottish Exhibition

An electrical exhibition arranged by National Electrics, Ltd., in collaboration with the Motherwell and Wishaw Burgh Electricity Department, was held recently at the Town Hall, Motherwell. The display included electric cookers, fires, lamp standards, lighting fittings, irons, toasters, vacuum cleaners, &c. At the opening ceremony Mr. W. D. Brassington, the burgh electrical engineer, said that electric cooking at ½d.



Part of the electrical exhibition at Motherwell

per kWh was cheaper than any other form of cooking in the town. A section of the exhibition is shown in the accompanying illustration.

An Important Telephone Contract

Mr. G. W. Moore, chairman of the Automatic Electric Co., has confirmed that his company, acting for itself and a group of leading British cable manufacturers, has concluded a contract with the Minister of Communications of Lithuania for the conversion of the present manual telephone system in Kaunas (Kovno), the capital of Lithuania, and Klaipeda, the principal port of the country, to the Strowger automatic system. The contract is for the installation of 8,000 lines in Kaunas and 3,000 lines in Klaipeda, and the modernisation of the cable network in these two cities. The work of installation is to be completed by September 1st, 1936. All the telephone material and the cables supplied will be of English manufacture.

The E.D.A. December Programme

The Sales and Publication Programme of the British Electrical Development Association for December is, of course, almost entirely devoted to publicity matter relating to electrical gifts for the festive season. Special attention is drawn to the Christmas window displays prepared by the Association, two of which were illustrated in our last issue. Local advertisements are reproduced, while examples are given of designs in the form of "Neopost" blocks for use in stamping machines, and stereos for overprinting envelopes, or for use as rubber stamps. The usual price list of seasonable literature is included.

"J. & P." in North Wales

Referring to the article entitled "Electrifying North Wales" in our last issue, Messrs. Johnson & Phillips, Ltd., tell us that the 20-kV double-circuit steel-mast line illustrated is a section of the extensive work which they have carried out in the area. The Afon Dwyrd crossing is also a part of over 100 miles of modern 11-kV and 35-kV lines erected by the company. Messrs. Johnson & Phillips confirm the statement regarding the long life of wood poles. Twenty years ago they erected in the area a considerable length of overhead transmission lines upon wood poles; a recent inspection showed that they are still in excellent condition.

New Catalogues and Lists

Jointless Firebrick Co., Ltd., 170, Piccadilly, W.—A leaflet containing illustrated particulars of the "Phibrico" observation port designed to enable combustion conditions in furnaces to be inspected in comfort and safety.

M. & C. Switchgear, Ltd., Kirkintilloch, Glasgow.—A leaflet illustrating a typical example of the company's oil circuit-breaker gear installed in a textile factory.

Ruston & Hornsby, Ltd., Lincoln.—An illustrated brochure giving details of fuel oil locomotives.

C. A. Parsons & Co., Ltd., Heaton Works, Newcastle-on-Tyne.—Leaflet No. 33 entitled "Parsons Iron and Brass Foundry Products."

Electrical Equipment & Carbon Co., Ltd., 107/111, New Oxford Street, W.C.—Brochure No. S.P.4407 giving full details of "Silit" rods and tubes for heating elements for furnaces.

Linolite, Ltd., 96, Victoria Street, S.W.—Leaflet No. 33A, specially prepared for the use of wholesalers, containing in condensed form particulars of "Linolite" lampholders and other products of the company.

General Electric Co., Ltd., Magnet House, Kingsway, W.C.—A booklet (A.G. 6729), and a leaflet (A.G. 6748), describing "Magnet" electric soil-heating cables and tubular heaters for garden frames and greenhouses. Illustrated.

Philips Lamps, Ltd., 145, Charing Cross Road, W.C.—A valve replacement chart showing the correct type of rectifying tube and resistance lamp for over sixty of the better known types of battery chargers.

Hart Accumulator Co., Ltd., Stratford, E.—A card (No. 246), giving prices of Hart "K B" type cells.

TayNor Machines, Ltd., 29, Store Street, W.C.—An illustrated pamphlet describing the "TayNor" shoe-cleaning machine.

Oerlikon, Ltd., Victoria House, Southampton Row, W.C.—Bulletins Nos. 145-7, describing turbo-generators installed by the company at the Thiers power station of the Mines d'Anzin, electric railway equipment, and laboratory magnets.

Burston Spanner Co., Ltd., Sherwoods Road, Oxhey, Watford.—A pamphlet relating to the Burston rapid action cam hammer.

L. G. Hawkins & Co., Ltd., 30/35, Drury Lane, W.C.—A folder, printed in colour, relating to the "Supreme" electric hair dryer and announcing a new scenting and deodorising attachment.

Brown Bros., Ltd., Brown's Buildings, Great Eastern Street, E.C.—A 16-page list illustrating Glassware decorative shades and bowls.

Ferranti, Ltd., Hollinwood, Lancs.—List Wb. 537, illustrating and describing the complete range of Ferranti radio receivers.

Milne & Longbottom, Elm Works, Mere Lane, Rochdale.—A pamphlet containing illustrated particulars of the "Elm" contactor starter.

George Ellison, Ltd., Perry Barr, Birmingham.—A booklet containing notes on the installation and maintenance of Ellison switchgear.

Peter Brotherhood, Ltd., Peterborough.—Publication B.J.33, describing the British Junkers high-speed Diesel engines. Illustrated.

Melvin Bros., Ltd., West Nicolson Street, Edinburgh.—Literature illustrating and describing the Melvin patent clock light signal.

Thomas Broadbent & Sons, Ltd., Central Ironworks, Huddersfield.—The fourth edition of the catalogue of Broadbent high-grade centrifugals, fully illustrated. Reference to the various sections is facilitated by a thumb index.

Bankruptcy Proceedings

T. E. Harvey, 64, Leagrave Road, Luton, Beds, radio and electrical engineer.—The public examination herein was held at the Court House, Luton, recently. The statement of affairs showed a deficiency of £138, but debtor considered that he was solvent. He had made an arrangement with several of his creditors, but the landlord had pressed his claim. He added that he commenced business on his own account in April, 1932, at his private house, and later opened a shop at Leagrave Road. At the outset he supplied radio sets on hire-purchase terms, but he found that that business was unsuccessful, his customers defaulting in payments after two or three months. The examination was adjourned for the signing of the notes.

C. J. Mount, electrical contractor, "White House," East Acton Lane, W.—Receiving order made November 15th on debtor's own petition.

G. W. C. Laws, radio and electrical engineer, 9, Queen's Road, East Grinstead.—Receiving order made November 16th on debtor's own petition. First meeting December 4th at the Official Receiver's offices, 8, Old Steine, Brighton. Public examination December 6th at the Town Hall, Tunbridge Wells.

F. W. Chattaway and **J. A. London** (Spa Electric & Radio Co.), electrical and radio engineers, 1, Church Walk, Leamington Spa.—Receiving order made November 18th on debtors' own petition.

S. Simmons, electrical engineer, 189, Whalley New Road, Blackburn.—First and final dividend of 2s. 0½d. in the £, payable November 27th at the Official Receiver's office, District Bank Chambers, Blackburn.

T. E. Harvey, 64, Leagrave Road, Luton, Bedfordshire, radio and electrical engineer.—The receiving order herein was made recently on the debtor's own petition, and at the first meeting of creditors, held at the Official Receiver's office, 6, The Parade, Northampton, the statement of affairs showed liabilities of £432, with assets of £262.

C. Lewis, electrical and wireless dealer, late of 2, St. Lawrence Road, Upminster.—Receiving order made November 22nd on a creditor's petition. First meeting December 5th and public examination February 9th, both at Bankruptcy Buildings, Carey Street, W.C.

R. F. Palmer, electrical engineer, 19, Church Street, Burnley.—Public examination December 18th at the County Court House, Burnley.

S. J. Garrod (Electrical Repair and Manufacturing Co.), electrical engineer, 181, St. John Street, E.C.—Last day for receiving proofs for dividend December 8th. Trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.

B. Hetherington, wireless dealer, Westgate, Elland.—Last day for receiving proofs for dividend December 9th. Trustee, Mr. J. O. Morris, 71, Manningham Lane, Bradford, Official Receiver.

C. G. Lowe (Tele-Radio & Electrical Supplies), radio and electrical dealer, 132, Burton Road, West Didsbury, Manchester.—Last day for receiving proofs for dividend December 9th. Trustee, Mr. F. Murgatroyd, Byrom Street, Manchester.

C. W. Everson (Eversons Electrical & Radio Depot), radio dealer, 93, High Street, Brownhills, near Walsall.—Last day for receiving proofs for dividend December 8th. Trustee, Mr. F. E. Bendall, 3, Warwick Passage, Corporation Street, Birmingham.

F. M. Clarke, electrical engineer, 3, Joyce Avenue, Sherwood, Nottingham.—First and final dividend of 3s. 6½d. in the £, payable December 6th at the Official Receiver's office, Nottingham.

Company Liquidations

Wholesale Wireless, Ltd.—Meetings, December 14th, at 12, Wood Street, Cheapside, E.C., to receive an account of the winding-up by the liquidator, Mr. W. Nicholson.

Derby Accumulator Supply Co., Ltd.—Meetings, December 15th, at 41, St. Mary's Gate, Derby, to receive an account of the winding-up by the liquidator, Mr. F. W. Farnsworth.

Imperial Light, Ltd.—Meeting, December 18th, at Victoria Station House, Victoria Street, S.W., to receive an account of the winding-up by the liquidator, Mr. N. M. Shaw.

Nox Electric Lamp Co., Ltd.—Winding up voluntarily. Liquidator, Mr. L. J. Coates, 2, East Parade, Leeds.

Rugby Electrical Engineering Co., Ltd.—Winding up voluntarily. Joint liquidators, Mr. G. Hay, 15, Market Place, Rugby, and Mr. A. Cripwell, 12, Cherry Street, Birmingham.

Private Arrangement

George Henry Eastwood, trading as "The Radio Stores," 85b, Parkinson Lane, Halifax.—A meeting of the creditors herein was held recently, at the offices of Messrs. C. L. Townend & Co., Halifax, when the statement of affairs showed liabilities of £105, and net assets of £48, or a deficiency of £57. It was stated that the debtor commenced business in October, 1931, without capital, and during the first twelve months he drew £2 per week, but since December, 1932, he had drawn 30s. per week. During the period to October, 1932, the sales were £662, but figures were not available for the period to October, 1933. The major portion of the household furniture was claimed by the debtor's wife. No offer was submitted, and it was decided that the debtor be given seven days in which to approach his friends and find a sum sufficient to pay a composition, failing which the assets should be realised under a letter of authority to Mr. Charles L. Townend, who would distribute the proceeds *pro rata* amongst the creditors.

J. & P. footballers in Westmorland

Dissolution of Partnership

Bowman & Webb, electrical engineers, 4, York Road, Southend-on-Sea.—Messrs. T. Webb and A. W. Bowman have dissolved partnership. Mr. Bowman will attend to debts and carry on the business.

Domestic Electrical Appliances in Belgium

THE Department of Overseas Trade has published a report, furnished by the Commercial Secretary to H.M. Embassy at Brussels, on the markets for domestic electrical appliances in Belgium. This states that the use of domestic electrical appliances by the general public is of comparatively recent date, and it is only during the last six or seven years that these articles have been brought to the attention of the mass of the population. The market is therefore relatively new and in consequence capable of great development. Electrical power companies, following the fall in industrial consumption of electricity, which began in 1925-6, began to take an interest in the domestic load and they have established departments for commercial propaganda, including electrical showrooms, and in some cases have engaged in the sale of appliances.

Firms entering this market will find that sales to electrical power companies offer few difficulties, but in the case of wholesalers and retailers the business is not so simple. There are about fifty wholesalers throughout the country whose purchasing power and financial standing vary considerably. The purchasing power of the retailers, of whom there are about 4,000, is very limited, and a manufacturer desirous of introducing his goods to any large extent must keep a good stock of the most popular material in Belgium, either in his own name or in that of a representative. In addition he must undertake careful advertisement and propaganda.

Many power companies have established such complicated tariffs and conditions that, so far as apparatus of high consumption is concerned, the Belgian market at present does not offer the possibilities it might. Prospects for the future are encouraging, however, and the situation may change rapidly when the questions of conditions and tariffs have been settled on a satisfactory basis.

Dealing with particular appliances, the report states that the radiators sold are almost exclusively used for supplementing the ordinary central heating. The sales of the parabolic radiator, which has enjoyed great popularity, have fallen since the introduction of the electric fire, the maximum consumption of which is generally 1 kW. It has been suggested that British radiators are too elaborate and expensive. There is an opening for the sale of these appliances, if United Kingdom firms are able to compete in price.

The sale of electric water-heating apparatus has not developed to any great extent, and is only employed in the districts where supply companies offer reduced tariffs. The tariff difficulties referred to have affected the sales of electric cookers, but a considerable increase is anticipated. There is a good demand for the hot-plate, which is generally supplied in three sizes, *viz.*: (a) diameter 13.5 cm., loading 600 W; (b) diameter 22 cm., 900 W; and (c) double warmer with two hot-plates of about 20 cm. diameter, one loaded to 800 W and the other to 1,200 W. Both the open element and the enclosed types are sold.

The vacuum-cleaner market has been very carefully organised by the big manufacturing firms, and it would seem difficult for a British firm to capture any large share in the trade without considerable expenditure on advertising and on the creation of an adequate organisation.

The electric iron is the best-known and best-introduced domestic appliance in the Belgian market. The annual sales are at least 150,000 and are continually increasing, while prices have fallen this year by more than 30 per cent. The standard American form is preferred and the most popular weight is from 2.5 to 2.8 kg. The model in most demand is entirely chromium-plated with a thumb-rest and a side stand.

Electric toasters are popular and should be suitable for 110, 130 and 220 V. They should be chromium-plated and with automatic bread-turner. The small hot-plate appears to have superseded the electric kettle, and the sales of the latter are on the down-grade. Electric hair-dryers have a good sale while other articles for which there is a demand are heating cushions, waffle irons and plate-warmers.

Summarising the position, the report concludes that United Kingdom manufacturers of domestic appliances are not yet known in Belgium and advertisement will be necessary in order to secure an introduction. It has been suggested that manufacturers ought to undertake a joint propaganda campaign. The strongest competition is from Germany, as German firms have been in the market for many years. The Belgian industry is of relatively slight importance as yet. The report includes appendixes showing the system of supply in the various towns in Belgium, and the names of supply companies engaged in the sale of domestic electrical appliances.

Electricity Supply

Lighting, Domestic, Power

Australia.—VICTORIAN ELECTRICITY COMMISSION BILL.—The Bill designed to prevent trading in electrical appliances by the Victorian Electricity Commission has passed its second reading in the State Legislative Assembly. An amendment to appoint a Select Committee to inquire into the question of electrical trading was rejected.

BRISBANE.—YEAR'S WORKING.—Mr. F. H. Hindman, manager of the City Council's electricity undertaking, has sent us his annual report for the year ended June 30th, 1933. The total revenue for the year amounted to £295,495, from which is deducted a total expenditure of £277,113, leaving a net balance of £18,382. During 1932/33, 24,994,419 kWh of electricity was sold, as compared with 20,875,305 kWh in 1931-32 and 7,231,607 kWh during 1926. A new tariff schedule involving a reduction in charges will operate during 1934.

Bedford.—LOAN SANCTIONED.—The Electricity Committee has obtained sanction to a loan of £50,000 for mains and services.

Bingley.—BULK SUPPLY CHANGE.—The Urban District Council has entered into an agreement with the Yorkshire Electric Power Company for a bulk supply of electricity, as from April 1st, 1934. The supply has previously been taken from the Keighley Corporation.

Blackpool.—EXTENSIONS.—The Electricity Committee is applying for permission to borrow £90,000 for cable-laying. A scheme has also been passed for further extension of the cables in the Marton area costing £4,000. Another scheme for extending mains from Singleton to Weeton-with-Preese, Westby-with-Plumpton, and Marton, involving £8,000, has been approved.

CONTINUED PROGRESS.—The increase in the output of electricity during the last seven months has been about 3,000,000 kWh; there has been a 50 per cent. increase as compared with the same period last year in the number of consumers added.

Canada.—PROGRESS DURING AUGUST.—The Dominion Bureau of Statistics, Ottawa, reports that the Canadian production of electricity in July and August was higher than has been recorded for the corresponding months in any other year; if the increase is sustained during the remaining months of the year the total production will not be far short of that reported for 1930, the highest year on record. In Quebec record figures have been returned for several months in succession, whilst in Ontario the load recovery has also been substantial. The revival indicated above is attributed largely to the increased demand by the mining industry, now depending almost entirely upon water power for its energy requirements. The total turbine installation in water-power plants on January 1st last amounted to 7,045,260 h.p., representing a little more than 16 per cent. of the total potential installation. No new water-power undertakings of magnitude have been initiated for this year, but work has been continued on several plants already under construction at the beginning of the year.

Carrickfergus.—EXTENSIONS.—The Urban District Council is seeking permission to borrow £18,000 for electricity extensions.

Chesterfield.—NEW SCHEMES.—Developments are being undertaken by the Electricity Committee, including the laying of e.h.p. cables in various parts, supplementary distributors, extensions of mains and new services. An application is to be made for sanction to a loan of £26,480 to cover the cost of the schemes.

Coventry.—FRINGE ORDER.—The Electricity Committee recommends consent to a Fringe Order enabling the Warwickshire Electric Power Co. to supply premises at Bedworth Hill.

Croydon.—LOANS.—The Electricity Committee is seeking sanction to borrow £50,000 for mains extensions, £10,000 for street-lighting fittings, and £20,000 for rental wiring installations.

EXTENSIONS.—The Electricity Committee is to extend mains at a cost of £2,693.

Dover.—EXTENSIONS.—The Town Council has applied for a loan for mains extensions and the provision of kiosks and sub-stations. The work includes extensions from the Duke of York's School to St. Margaret's, at an estimated cost of £3,430, from the Golf House, St. Margaret's, to Colinwood Road, Nelson Park Estate (£4,710), and from Crabble Hill to Temple Ewell (£4,200).

Eastbourne.—TWO-PART FLOODLIGHTING TARIFF.—The Electricity Committee has decided that the two-part tariff shall be the only tariff applicable for floodlighting and not an alternative to the existing tariff.

Eastry.—OVERHEAD LINES.—The Rural District Council has approved the erection of overhead cables from Canterbury to Sandwich in its district, by which supplies will be made available for Ash and Wingham.

Germany.—OUTPUT DURING JULY.—The output of the 122 principal electricity supply undertakings in Germany during July last attained a total of 1,049,500,000 kWh, bringing up the aggregate for the first seven months of the current year to 7,717,900,000 kWh as compared with 7,183,000,000 kWh in the corresponding period of 1932, an increase of about 7½ per cent.

Guildford.—NEW MAINS.—The Electricity Committee is to renew mains in Merrow Street (£927), and extend mains to Winterhill Estate (£934).

Halifax.—CHARGE REDUCTION.—The Electricity Committee recommends further reductions in the standing charges for electricity service. On the domestic tariff the charge was reduced after the September meter readings from 1s. to 11d. per £ of rateable value per quarter, and the new recommendation is a reduction to 9d. from the December readings. For combined house and shop properties it is proposed to reduce the charge from 1s. 4d. per £ of rateable value per quarter to 1s. 3d.

Helmsdale.—ELECTRICAL DEVELOPMENT.—A private firm, Messrs. A. R. M'leod & Sons, has erected a power station in Strathnaver Street with sufficient output to provide lighting for the whole of the community. It has also secured the street lighting, as well as the large public and private business premises, and is gradually linking up the entire district.

Hull.—ELECTRIC HEATING FOR SCHOOL.—The Education Committee has decided, as an experiment, to install electric heating at the new school at Sutton Ings.

THERMAL STORAGE HEATING INSTALLATION.—The Housing Committee has arranged for the electrical engineer to install heating on the electro-thermal storage system at premises in Ferensway at a cost of £1,900.

LOAN.—The Electricity Committee is to apply for sanction to borrow £15,000 for prepayment meters and £24,205 for distribution extensions.

Kirkwall.—LOWER CHARGES FOR LARGE CONSUMERS.—Lower rates for electricity have been granted by the Town Council to three consumers who threatened to install their own plant if they were not allowed a substantial reduction. The resultant loss of business to the Council would have amounted to over £600 yearly. Each firm is now to pay £150 per annum and 1d. per kWh.

Lincolnshire.—ELECTRIC LIGHTING.—Kesteven County Council is to spend £1,380 on installing electric light at the Grantham Institution.

London.—FULHAM.—The Electricity Committee reports that it has under consideration the question of improving the lighting in the side streets of the borough. After an inspection of various types of lamps, it has decided to use the lantern known as "Four Bi-Multi A.L.," which is manufactured by the Electric Street Lighting Apparatus Co. The Committee has also considered the desirability of fitting each post with a time switch, which will enable the lights to be switched on or off at a predetermined time. The total estimated cost of effecting the improvement in street lighting outlined above is £6,113, which would provide 1,500 reflector fittings.

ST. PANCRAS.—The Electricity Committee is to extend mains at a cost of £1,733.

The L.N.E. Railway is to install an electric thermal storage heating system at its King's Cross offices.

SHOREDITCH.—The report of the electricity undertaking for the year ended March 31st, 1933, shows that the sales of electricity were 26,805,824 kWh, an increase of 2,299,775 over the previous year, while the revenue from the sale of energy amounted to £184,359 as compared with £183,534. The number of consumers was 20,021, which is 2,199 more than last year, and the gross profit amounted to £82,800.

Mildenhall.—SUPPLY TO LAKENHEATH.—The Rural District Council has decided to offer no objection to the use of overhead lines for a supply of electricity to Lakenheath by the East Anglian Electric Supply Co., Ltd.

Millport.—ELECTRICITY TO BE INTRODUCED.—A committee has been appointed by the Town Council to inquire into the question of introducing electricity into the borough.

Newark-on-Trent.—ELECTRICITY TO REPLACE GAS.—The Notts C.C. Assistance Committee has now approved a scheme for the provision of electricity in place of gas at the Newark Institution at a cost of £500.

New Zealand.—CHRISTCHURCH.—The annual report of the electricity undertaking has been sent to us by the general manager, Mr. E. Hitchcock. It shows a balance of £16,104, as compared with £32,712 for the previous year. The revenue amounted to £207,819 (£219,884 in 1932), and the working costs were £61,427 (£52,687). About 50,543,090 kWh was sold, as compared with 49,100,560 kWh during the previous twelve months.

Northern Ireland.—COOKSTOWN.—The Northern Ireland Electricity Supply Board has completed arrangements with the Cookstown Gas and Electric Power Company for the acquisition of the latter's electricity undertaking in March, 1934.

Padiham.—REDUCED CHARGES.—The charge for electricity through prepayment meters is to be reduced to 5d. per kWh.

Preston.—LOANS.—The Electricity Committee intends to make application for powers to borrow £45,000 for the purchase of domestic appliances and £60,000 for mains and services.

AN EXTENSION OF THE SUPPLY AREA.—The Corporation proposes to apply for an extension of its supply area to include Preesall—a residential district. There are a number of poultry farms, which would provide a useful load in addition to Imperial Chemical Industries, Ltd., and a corn mill. No gas supply is available in the area. In 1925 the district obtained an Electricity Order, and there are mains sufficient to carry

a considerable cooking and heating load. It is proposed to purchase this undertaking for £15,000, the Corporation giving supplies at 6,600 V from its sub-station at Stalmine by an overhead line terminating at Preesall sub-station. An additional sub-station will be required at Knott End. The cost of the overhead line, &c., will be £2,200, making the total initial expenditure about £16,200.

Russia.—ANGARASTROY HYDRO-ELECTRIC POWER STATION.—A new hydro-electric station at Angarastroy is under construction and will, it is estimated, make it possible to obtain electrical energy from the River Angara at the rate of 36 kopeks per kWh. The upper station at Lake Baikal, 8 km. above Irkutsk, will be the control station for the entire system and will have a generating capacity of 3.6 billion kWh per annum. The next station of the system, which will be known as the Barkhatov station, will be situated 150 km. below Lake Baikal, and will have an annual generating capacity of 5.25 billion kWh. The Bratskaya station, with an annual generating capacity of 17.5 billion kWh, will be situated 500 km. below the Barkhatov station. Three smaller stations, with capacities of 2 million kWh, 1.7 million kWh and 1.4 million kWh respectively, will complete the system.

ELECTRICITY OUTPUT FIGURES FOR 1933.—According to a report issued by the International Office of Labour at Geneva, the output of electricity in Soviet Russia during the first half of the current year amounted to about 7,400 million kWh, which shows an increase of 21 per cent. over the similar period of 1932 and is only 2.4 per cent. below the amount aimed at under the Second Five Year Plan.

Sherington (Northants).—NEW SUPPLY.—An electricity supply has recently been taken to Sherington.

South Africa.—PROPOSED RECONSTRUCTION AT KRUGERSDORP.—Mr. A. S. Posthumun, town engineer of Krugersdorp, reports that the municipal electricity supply system is carrying two and a half times the normal load for which it was designed. The Council is faced with the necessity of reconstructing the whole of its electricity system at a cost of about £31,000.

Stokesley.—SUPPLY EXTENSIONS.—The Rural District Council has decided not to oppose a scheme by the North-Eastern Electric Supply Co., Ltd., for an extension of the electricity supply in the Hemlington area and Springfield.

Stoke-on-Trent.—SUPPLY EXTENSION.—The Electricity Committee is to arrange for a supply to the Highfield Farm Estate, Wolstanton, where 600 houses are to be erected. The cost of the first section is estimated at £1,250.

BULK SUPPLY TERMS.—The Electricity Committee has arranged terms for a bulk supply to the Shelton works of the Shelton Iron, Steel & Coal Co., Ltd., at £3 10s. per kW per annum, plus a running charge of 0.3d. per kWh for a maximum demand of about 2,000 kW and an annual consumption of between five and six million kWh.

LOAN.—The Committee is applying for sanction to a loan of £4,500 for the provision of electricity to Goldenhill.

Sowerby (Thirsk).—SALE OF UNDERTAKING.—The Parish Council has refused an offer from the North-Eastern Electric Supply Co. to sell the lighting installation. The Clerk reported that the company's offer stated that the installation cost £912 and they were prepared to sell it for £700. The Council was paying about £298 per year for electricity, and if it bought the equipment this would be reduced to £208. It was further stated that £700 could be borrowed at 4½ per cent. over a period of twenty years. This would result in a saving of £34 a year. The company would supply time switches at £32 a year for twenty years, which would save £18 a year in lamplighter's wages. Against that the Council would have to undertake the cost of repairs. The chairman said the underground cables were almost at the end of their life, and that the Ministry of Transport would not be likely to allow the Council to borrow for the purpose.

Stonehaven.—ELECTRICITY SCHEME.—The Town Council is to introduce electricity for street lighting and for the use of the community, and an agreement between the Grampian Electricity Co. and the Council has been approved. The annual cost to the town will be about £400, and the cost of electricity to users will be 8d. per kWh.

Straits Settlements.—SINGAPORE.—The annual report for the year ended December 31st, 1932, shows a rise in the amount of electricity sold from 31,295,700 kWh to 33,921,200 kWh. The total revenue was $2,247,419, of which $898,107 was absorbed by working expenses. The balance, which amounted to $440,775, was transferred to the appropriation account. The engineer of the undertaking is Mr. E. W. P. Fulcher.

GEORGE TOWN, PENANG.—During the year ended December 31st, 1932, the amount of electricity sold decreased from 11,458,988 kWh in 1931 to 10,071,428 kWh. The revenue totalled £126,900, with working expenses £69,001,

An E.L.M.A. lighting display at Evesham during the recent electrical exhibition held in the town under the auspices of the S.W. & S. Co.

leaving a gross profit of £57,899, from which was deducted interest on loans and sinking fund contribution, leaving a net profit of £7,475.

Todmorden.—LOAN.—The Electricity Committee has obtained sanction to a loan of £3,000 for transformers and switchgear.

Winchester.—SUPPLY TO FAOR OAK.—The West Hampshire Electricity Co., Ltd., has informed the Rural District Council of its intention to erect overhead cables for a supply of electricity at Faor Oak, where houses are being erected, and the Council has decided to offer no objection.

Wotton-under-Edge.—SUPPLY TO WATERWORKS.—The Parochial Committee has accepted the terms of the West Gloucestershire Power Co. for a supply of electricity for the waterworks pumping station, on a fifteen years' contract.

Corrections.—In the table of municipal supply undertakings' results published last week, the sales of electricity by Norwich Corporation should have read 45,875,778 kWh for 1932-33 and 43,870,834 kWh for 1931-32, instead of 4,078,854 kWh and 2,941,608 kWh respectively.

In our issue of November 17th we incorrectly stated that the net profit of the Cannock Urban District Council's electricity undertaking for 1932-33 was £282, as compared with a loss of £618 on the previous year. These figures are the balances shown on the net revenue account after meeting capital charges, and taking into consideration deficits carried forward from previous years. The actual results were a net loss of £50 for the year ended March, 1932, and a net profit of £900 for the year ended March 31st last.

An Important Trolley-bus Project for London

SINCE the London Passenger Transport Board acquired the fourteen tramway undertakings in the London area plans have been prepared for the conversion of ninety miles of tramways to trolley-bus operation.

On July 1st, when the Board took over, seventeen miles were worked by trolley-vehicles, and 310 miles by tramcars. On this seventeen-mile route sixty trolley-vehicles were run, and they carried twenty-seven million passengers during 1932, while 2,600 tramcars carried 1,030 million passengers. The trams are to be retained in the Central London area where the traffic is very dense and the stops frequent, the greater part of the change-over taking place in the suburbs.

The following list shows the routes which it is proposed to convert:—

(*a*) Hammersmith and Shepherd's Bush, *via* Kew, Brentford and Isleworth, to Hampton Court and Hounslow.

(*b*) Hammersmith and Shepherd's Bush, *via* Acton, Ealing, Hanwell, Southall, Hayes, and Hillingdon to Uxbridge.

(*c*) Hanwell *via* Boston Road and Boston Manor to Brentford.

(*d*) Acton *via* Harlesden, Willesden, Cricklewood, Hendon and Edgware to Canons Park.

(*e*) Paddington *via* Harlesden and Wembley to Sudbury.

(*f*) Woolwich, Beresford Square, *via* Plumstead, Welling, Bexley Heath, and Crayford to Dartford.

(*g*) Woolwich, Beresford Square, *via* Plumstead, Abbey Wood, and Erith to Bexley Heath.

(*h*) Crystal Palace, High Level, *via* Selhurst, West Croydon, Waddon, and Wallington to Sutton.

(*i*) Euston *via* Hampstead Road, Camden Road, Seven Sisters Road, Manor House, Green Lanes, and Wood Green to Palmers Green, Winchmore Hill, and Enfield Town, and to New Southgate, Friern Barnet, and North Finchley.

It is also proposed to extend the route from the existing Euston terminus in Euston Road to a point in Tottenham Court Road near its junction with Oxford Street, and thus make further provision for the City traffic. Only a very small portion of the route to be converted (Euston to Finsbury Park, and Paddington to Kensal Green) lies in the former L.C.C. Tramways area. The proposals will be contained in a Bill to be promoted during the current session of Parliament.

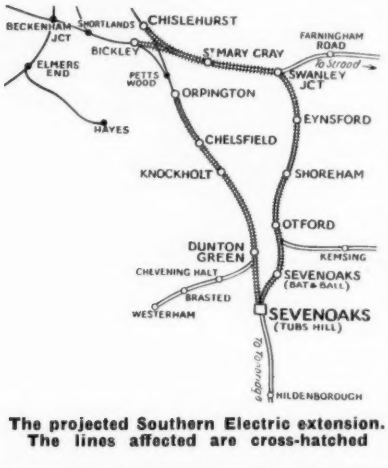
Traction

Huddersfield.—TROLLEY-BUS SERVICES.—On Monday the inauguration of the first trolley-bus service will take place. Six buses are to be placed in operation on a route from the centre of the town to Almondbury. During the next twelve months it is intended to convert two further tram routes to trolley-bus working.

Mexborough.—TROLLEY-BUS SERVICE.—A Provisional Order is being sought by the Mexborough and Swinton Traction Co. for the introduction of a new trolley-bus service between Rotherham and West Melton, partly over the company's own system, and partly over that of the former Dearne District Light Railway.

Plymouth.—PURCHASE OF TORQUAY TRAMCARS.—The Corporation has purchased twelve of the Torquay Tramway Co.'s cars, as the latter's services are now being worked by motor buses.

Southern Railway.—FURTHER ELECTRIFICATION.—Already the Southern Railway has the largest electrified suburban system in the world, and it now proposes to electrify another 23 miles of route. The extension is from Chislehurst and Orpington and embraces the places shown in the accompanying map. The cost is estimated at over £500,000 and the third-rail d.c. system, as elsewhere on the Southern Electric, will be used. The stations affected are Orpington, Chelsfield, Knockholt, Dunton Green, Sevenoaks (Tub's Hill), St. Mary Cray, Swanley Junction, Eynsford, Shoreham, Otford, and Sevenoaks (Bat and Ball). The trains will consist of eleven three-car motor units and four two-car trailer units.



The projected Southern Electric extension. The lines affected are cross-hatched

The new electric services will be supplementary to the existing main line steam trains, the number of trains serving the various stations being increased to the extent of from 86 to 209 per cent.

Spain.—RAILWAY ELECTRIFICATION.—It is announced from Madrid that the Ministry of Public Works has granted definite authority for the electrification of the line between Vitoria and Mecolalde (the Basque country) at an estimated expenditure of 9,000,000 French francs.

Straits Settlements.—GEORGE TOWN, PENANG.—The annual report of the working of the Tramways Department shows a further decrease in the number of passengers carried, which amounted in 1932 to 8,358,815 as compared with 9,103,212 during 1931. The total revenue was £27,544, of which £23,408 was accounted for by working expenses. After meeting interest on loans and sinking fund payments there was a net loss of £651.

Sweden.—ELECTRIFICATION OF STATE RAILWAYS.—A *Reuter's Trade Service* message from Stockholm says that the whole State railway line between Malmö and Stockholm, a distance of 599 km., had been electrified by October 1st, and on December 1st electric traffic is starting on the Malmö-Trälleborg line, a distance of 31 km., so that after that date the trains for the Continent will be hauled all the way from Stockholm to the south of Sweden by electric locomotives. Electrification work on other important State Railway lines continues, and it is hoped that the Oerebro-Krylbo junction line (132 kilometres) will be opened for electric traffic on October 1st, 1934. When this electrification is complete, express trains from Malmö and the Continent to Norrland towns will no longer run *via* Stockholm, but *via* Mjoelby-Hallsberg-Oerebro-Krylbo, thus saving much time.

Traffic Signals.—NEW INSTALLATIONS.—The Willesden Corporation is to provide traffic signals in Mill Lane at a cost of £600.

A special "hurry" or "express" call facility is a feature of the new "Electromatic" vehicle-actuated traffic-control signals which have been inaugurated at the six-way intersection of Rimrose Road/Knowsley Road/Crosby Road between Bootle and Seaforth, one of the most complex traffic points in the North of England. The principle of the "Electromatic" vehicle-actuated signal is now generally understood, but here the short communicating roadway under the railway bridge joining the Rimrose Road/Knowsley Road/Regent Road junction has introduced complications. The special "hurry" call feature has accordingly been incorporated by virtue of which, main road traffic on the Rimrose Road/Crosby Road route, upon crossing the detectors in those road makes a "hurry" or "express" call to the signal lights on the far side of the bridge. This ensures that vehicles can in no circumstances be halted in the road under the bridge and in consequence the traffic flow can never be congested at this point. The equipment has been manufactured and installed by the Automatic Electric Co., Ltd.

The Great Yarmouth Town Council has applied to the Minister of Transport for the installation of traffic signals at the junction of Admiralty Road and Queen's Road, and Nelson Road and Trafalgar Road.

Automatic traffic-control signals are also to be installed in Perth at South Street Port.

The St. Pancras Highways Committee is to install automatic traffic signals at a cost of £2,380.

The Watford Borough Council Highways Committee recommends the provision of traffic signals at three road junctions (£1,465); and the Finsbury Highways Committee is to install vehicle-actuated traffic signals at the Angel junction (£1,500).

Communications

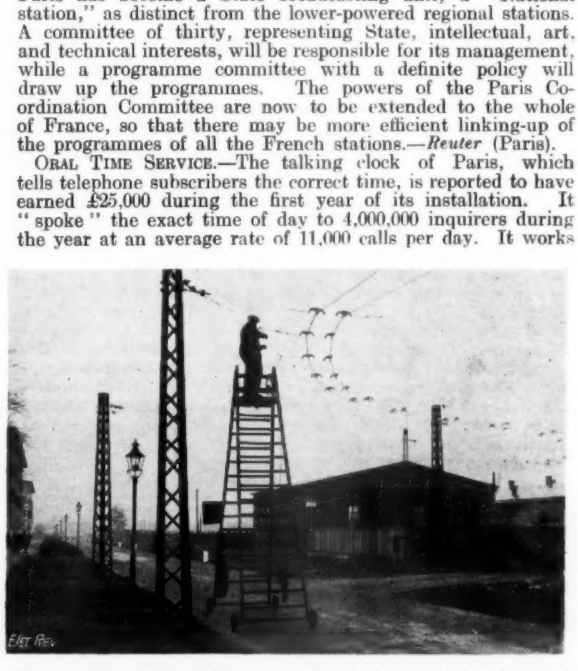
Australia.—AUTOMATIC TELEPHONY.—Experimental automatic telephone exchanges in country districts have given every satisfaction, and it is hoped to establish twenty more during the next financial year. The number of telephones in use in Australia at the end of September was 489,635. In the first three months of the current financial year the increase was 2,006, compared with an increase of 713 in the corresponding period of last year.

RADIO PATENTS.—A pooling of patents employed in wireless work has been arranged between Amalgamated Wireless (Australasia), Ltd., Philips Lamps, Pty., Ltd., and Standard Telephones, Ltd. These companies are negotiating with Radio Interests, Ltd., another large patent owner, in the hope of being able to issue a single form of licence to cover the use of all the patents of the combined organisations.

Federated Malay States.—TELEPHONY.—A report lately issued by the F.M.S. Postal and Telegraph Department shows that the direct exchange lines connected to the telephone system at the end of 1932 numbered 3,939, or 824 fewer than a year earlier. In addition, there were 2,000 extension and private lines, a decrease of 252. Public call offices numbered ninety-seven and public exchanges sixty-seven, the same as in 1931. The revenue from the telephones was 981,237 Straits dollars, or 196,982 dollars less than in 1931.

France.—NATIONAL CONTROL OF BROADCASTING.—French broadcasting is to be run on more "National" lines. Radio-Paris has become a State broadcasting unit, a "National station," as distinct from the lower-powered regional stations. A committee of thirty, representing State, intellectual, art, and technical interests, will be responsible for its management, while a programme committee with a definite policy will draw up the programmes. The powers of the Paris Co-ordination Committee are now to be extended to the whole of France, so that there may be more efficient linking-up of the programmes of all the French stations.—*Reuter* (Paris).

ORAL TIME SERVICE.—The talking clock of Paris, which tells telephone subscribers the correct time, is reported to have earned £25,000 during the first year of its installation. It "spoke" the exact time of day to 4,000,000 inquirers during the year at an average rate of 11,000 calls per day. It works



Erecting the overhead wires for Berlin's first trolley-bus service between Spandau and Staaken

hardest at about 8 a.m., but on Sundays and holidays has to answer only 6,000 calls.

Switzerland.—TRUNK TELEPHONY.—The Swiss Post and Telegraph authorities have recently commenced work on the establishment of a trunk-line telephone service in the Valais, after a postponement of several years. The line will be about 97 miles in length and will extend along the banks of Lake Leman and across the Rhône plain as far as Brigue. It will be connected with the telephone cables which pass through the Simplon Tunnel, where on the Italian side they are to be connected to the Italian telephone system at Iselle, so that a completely underground connection between Geneva and Milan will bcome available.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Aldershot.—December 5th. Electricity Department. E.h.p. switchgear and e.h.p. oil-cooled transformers. (November 24th.)

Arbroath.—November 30th. Town Council. Various works, including electrical, at housing scheme. Specifications, &c., from burgh engineer (deposit £1); offers to Town Clerk, Town House, Arbroath.

Argentina.—BUENOS AIRES.—December 4th. State Oilfields. Portable arc-welding equipment and grinding machine. (A.Y. 12076.)* Rotary air compressor. (G.Y. 13146.)*

Australia.—MELBOURNE.—Post and Telegraph Department. December 5th. Microphones. (A.Y. 12030.)* Telephone switchboard cable. (A.Y. 12015.)*

December 12th. Telephone parts and accessories. (A.Y. 12032.)* Telephone indicators. (A.Y. 12033.)* Multiple twin telephone cables. (A.Y. 12016.)*

December 19th. Telephone dial parts. (A.Y. 12031.)* Vitreous resistances. (A.Y. 12042.)*

January 2nd. Telephone switchboard lamps and sockets. (A.Y. 12053.)* Telephone jacks and number plates. (A.Y. 12066.)*

January 9th. Hand-operated telephone generators. (A.Y. 12064.)* Bells and buzzers. (A.Y. 12065.)*

January 16th. Telephone timing clocks. (A.Y. 12085.)* Telephone switchboard keys and accessories. (A.Y. 12081.)* Resistances and reactances. (A.Y. 12083.)*

January 23rd. Telephone trunk test boards. (A.Y. 12091.)*

State Electricity Commission of Victoria. December 4th. 22,000-V switchgear and accessories comprising oil circuit-breaker equipments with current transformers. (A.Y. 12014.)*

January 8th. Five automatic induction voltage regulators. (A.Y. 12071.)* 115-kW a.c. motor. (A.Y. 12053.)*

January 15th. Triple-braided copper conductor. (A.Y. 12054.)*

BRISBANE.—January 31st. City Electric Light Co., Ltd. Land and submarine cable. (A.Y. 12072.)*

February 7th. 44-kV switchgear. (A.Y. 12092.)*

Caithness.—December 21st. County Council. Various works, including electric lighting at new school building, Thurso. Schedules from Messrs. Sinclair, Macdonald & Son, architects, Wick and Thurso (deposit 2 guineas); tenders to Mr. D. W. Georgeson, clerk to the Education Committee, Wick.

Dover.—December 13th. Corporation. Rewinding motors and other electrical apparatus in connection with the change of frequency. (See this issue.)

Dunfermline.—December 5th. Town Council. Various works, including electric lighting, at fifty-two houses at Townhill. Schedules, &c., from Mr. D. H. Shaw, burgh engineer, City Chambers (deposit one guinea); tenders to Town Clerk.

Erith.—December 7th. Electricity Department. Three 500-kVA transformers. (November 24th.)

Ferryhill.—West Cornforth Industrial Co-operative Society, Ltd. Installation of electric lighting at the Ferryhill branch. Particulars from the branch manager, High Street, West Cornforth.

Fife.—December 12th. County Council. Various works, including electrical installation, at alterations and additions to St. Margaret's R.C. School, Dunfermline. Schedules (deposit £1 1s.) from Mr. G. Sandilands, Education Offices, Wemyssfield, Kirkcaldy; offers to Mr. J. M. Mitchell, county clerk, County Buildings, Cupar.

Glasgow.—December 7th. Corporation. Various works, including electric lighting installation, at school and child welfare centre, Garngadhill. Specifications, &c., from Office of Public Works, Room 31, City Chambers (deposit two guineas); tenders to Town Clerk.

Hastings.—December 2nd. Electricity Department. Supply of transformers for the year 1934. (November 10th.)

December 6th. Poles, ironwork, &c., for overhead lines. (November 24th.)

India.—NEW DELHI.—December 4th. Indian Stores Department. 200/230-V, single-phase, 50-cycle ceiling fans. (A.Y. 11959.)

December 11th. D.c. ceiling fans. (A.Y. 11965.)*

January 8th. A.c. and d.c. table fans. (A.Y. 11967.)*

Lanchester.—Rural District Council. Erection of overhead network in the Village of Burhope. Plans by the North-Eastern Electric Supply Co., Ltd., Room 264, Carliol House, Newcastle-on-Tyne.

Lochgelly (FIFE).—December 4th. District Council. Electric lighting installation at football dressing rooms and tennis pavilion at Bowhill, Cardenden. Tenders to Mr. C. Hornal, district clerk, Town House, Lochgelly.

London.—ST. PANCRAS.—December 7th. Borough Council. Vehicle-actuated traffic signals. (November 17th.)

New Mills.—December 8th. Electricity Department. E.h.p. cable, equipment and labour for mains extensions. (See this issue.)

New Zealand.—WELLINGTON.—Posts and Telegraph Department.—December 5th. 2,400 lb. of cored solder. (G.Y. 13046.)*

January 8th. Microtelephone cradles. (A.Y. 12046.)* Telephone jacks. (A.Y. 12045.)*

January 9th. A 100-Ah secondary battery with 60 cells. (A.Y. 12047.)*

January 16th. Thirty-five miles of v.i.r. wire. (A.Y. 12086.)*

January 16th. Public Works Department. Four 1,500-kVA transformers. (A.Y. 12017.)*

January 17th. Forty miles of flameproof telephone jumper wire. (A.Y. 12088.)*

CHRISTCHURCH.—January 11th. City Council. Single-phase and three-phase power transformers. (A.Y. 12089.)*

Persia.—TEHERAN.—January 7th. Municipal Council. Boilers, turbo-alternator sets, switchboards, transformers and cables, in connection with a proposed power station. (A.Y. 12079.)*

Portsmouth.—December 15th. Electricity Department. Eight 200-kVA and two 100-kVA three-phase transformers and two 500-kVA Scott-connected transformer groups. (See this issue.)

South Africa.—KROONSTAD.—December 4th. Municipal Council. Machinery and plant for a power station. (A.Y. 12004.)* Steam raising plant. (G.Y. 13038.)* Motors, meters, cable, transformers, conductors, kiosks and other electrical items. (A.Y. 12029.)*

JOHANNESBURG.—December 21st. City Council. Twelve air compressors and spares, three oil separators, three air receivers and single-phase motors, &c. (G.Y. 13152.)*

January 15th. Railways and Harbours. Train lamps and fittings. (G.Y. 13168.)*

Swansea.—December 4th. Corporation. Steam and feed water piping, valves, &c., for Tir John power station. (November 3rd.)

December 20th. Electricity Department. Boiler feed pumps, &c. (November 24th.)

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* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Chorley.—Markets Committee. Accepted. Battens, cables and fittings for canvas stalls in the market.—A. Ambrose.

Croydon.—Electricity Committee. Recommended. Repairing works battery (£194).—Alton Battery Co. A.c. motor (£81).—Laurence, Scott & Electromotors, Ltd.

Dorset.—County Council. Accepted. Installation of electric light at Colliton House (£110).—W. O. Knell.

Hull.—Telephones Committee. Recommended. Cable (£977).—British Insulated Cables, Ltd. Table instruments (£487).—Siemens Bros. & Co., Ltd. Inside wire (£78).—W. T. Henley's Telegraph Works Co., Ltd.

Kirkcaldy.—Town Council. Accepted. Electrical work at 100 houses (£377).—Miller & Stables.

London.—ST. PANCRAS.—Contracts and Stores Committee. Multicore cables and racking (£486).—A. Reyrolle & Co., Ltd.

HAMMERSMITH.—Electricity Committee. Accepted. E.h.p. cable (£574).—Standard Telephones & Cables, Ltd. Recommended. E.h.p. switch (£168).—Ferguson, Pailin, Ltd.

Sunderland.—Town Council. Accepted. Meters.—British Sangamo Co., Ltd.; Ferranti, Ltd.; Aron Electricity Meter, Ltd. Cables.—Metropolitan Electric Cable & Construction Co., Ltd.; W. Geipel, Ltd.

Walsall.—Town Council. Accepted. Electrical installation at the new George Hotel.—Truman Electrical Co.

Forthcoming Events

Physical Society.—Friday, December 1st. Imperial College of Science and Technology, South Kensington. 5 p.m. Short papers.

Association of Mining Electrical Engineers.—(*Kent Sub-Branch*).—Saturday, December 2nd. Dover Technical Institute. 6.30 p.m. "Developments in Modern Illuminating Engineering." Mr. J. M. Barnicot. (*London Branch*).—Tuesday, December 5th. Junior Institution of Engineers, London. 6.30 p.m. "Alkaline Batteries." Mr. F. Watson Mann. (*South Wales Branch*).—Saturday, December 9th. South Wales Institute of Engineers, Cardiff. 6 p.m. Paper by Dr. F. S. Sinnatt, Director of Fuel Research.

British Institute of Radiology (Röntgen Society).—December 6th-8th. Central Hall, Westminster. Annual congress and exhibition.

Illuminating Engineering Society.—Wednesday, December 6th. Liverpool Corporation Electricity Showrooms. 7.15 p.m. "Dock Lighting." Mr. J. S. Preston.

Royal Society of Arts.—Wednesday, December 6th. Adelphi, W.C. 8 p.m. "Radiometric Condensers and Inductances." Mr. G. G. Blake.

Edinburgh Electrical Society.—Wednesday, December 6th. Philosophical Institution, Edinburgh. 8 p.m. "Electrical Illumination as an Engineering Problem." Mr. T. Catten.

Rugby Engineering Society.—Wednesday, December 6th. "Vehicle-actuated Street Traffic Signals." Mr. T. P. Preist.

Electrical Association for Women.—Wednesday, December 6th. Regent Street, W. 8 p.m. Demonstrators' Circle dance.

Institution of Electrical Engineers.—Thursday, December 7th. Institution, London. 6 p.m. "The Application of Automatic Voltage and Switch Control to Electrical Distribution Systems." Messrs. W. Kidd and J. L. Carr. (*Meter and Instrument Section*).—Friday, December 1st. Institution, London. 7 p.m. "Current Transformer Testing" and "Leakage Phenomena in Ring-Type Current Transformers." Dr. A. H. M. Arnold. (*North-Eastern Students' Section*).—Saturday, December 2nd. 3 p.m. Visit to Pelaw Main Collieries coal-washing plant, Wrekenton. (*North Midland Students' Section*).—Saturday, December 2nd. Visit to B.B.C. Studios, Leeds. (*Mersey and North Wales (Liverpool) Centre*).—Monday, December 4th. University, Liverpool. 7 p.m. "The Low Voltage Sections of the British 'Grid' System." Mr. C. W. Marshall. (*South Midland Centre*).—Monday, December 4th. James Watt Memorial Institute, Birmingham. 7 p.m. "Recent Investigations on Telephone Interference" (E.R.A. report). Messrs. W. G. Radley and S. Whitehead. (*North-Eastern*

Centre).—Monday, December 4th. Rendezvous Restaurant, Newcastle-on-Tyne. 7 p.m. Informal meeting. Discussion on "Electricity as a Heating and Warming Agent." Opened by Mr. L. E. Mold. (*North Midland Centre*).—Tuesday, December 5th. Hotel Metropole, Leeds. 7 p.m. "The Travel of Wireless Waves." Sir F. E. Smith. (*North-Western Centre*). —Tuesday, December 5th. Engineers' Club, Manchester. 7 p.m. Mr. Marshall's paper. (*London Students' Section*).—Tuesday, December 5th. Imperial Hotel, Russell Square, W.C. 8 p.m. Dance. (*Scottish Centre*).—Tuesday, December 5th. North British Station Hotel, Edinburgh. 6.30 for 6.45 p.m. Special meeting. "Reminiscences of Early Days." Prof. F. G. Baily. (*Wireless Section*).—Institution, London. Wednesday, Decem-6th. 6 p.m. "The Spontaneous Background Noise in High-Gain Receivers due to Thermal Agitation." Messrs. E. B. Moullin and H. D. Ellis. (*East Midland Sub-Centre*).—Tuesday, December 5th. The College, Loughborough. 6.45 p.m. "The Grid-Controlled Mercury-Arc Rectifier." Mr. J. E. Calverley. (*South Midland Students' Section*).—Friday, December 8th. Boots Café, Birmingham. Annual dance.

Junior Institution of Engineers.—Friday, December 8th. Institution, London. 7.30 p.m. Inaugural meeting. Presidential address.

Notes

The Jubilee of a French Electrical Institution

A special meeting of the Société Française des Electriciens, at which the I.E.E. was represented, extending over three days, was held in Paris on November 23rd, 24th, and 25th, to celebrate the completion of the first fifty years' existence of the Institution. On the first day a visit was paid to the three-million-volt testing plant at the works of the Compagnie Générale d'Electro-Céramique at Ivry, while in the evening M. H. Parodi gave an address on "Fifty Years' Progress in the Utilisation of Electric Power." On the morning of November 24th the large new electric power station of the Société d'Electricité de Paris at St. Denis was visited, while later in the day papers were read by M. H. Milon on "The Development of Telecommunication by Wire and Cable," and M. Gutton on "Radio-Communications and their Applications." The celebrations were brought to a close on Saturday, November 25th, when, in the presence of the President of the French Republic, M. Langevin gave a lecture on "The Evolution of Electrical Science during the Past Fifty Years." The Jubilee celebration formed the concluding three days of the annual Discussion Week organised by the Société. Monday, November 20th, was devoted to a discussion on "The Production of Illumination and Ultra-violet Rays by Rare Gases" and "The Protection of Transformers against Excess Pressures." Among the subjects dealt with on the second day were "The Electrolysis of Copper," "Theoretical Aspects of the Electrolytic Formation of Metallic Deposits," and "The Synchronisation of High-frequency Currents," while on the third day among the subjects under discussion was that of "Current Intensities Dangerous to the Human Body."

The I.E.E. Birmingham Dinner

The annual dinner of the South Midland Centre of the Institution of Electrical Engineers took place on November 24th at the Grand Hotel, Birmingham, Mr. J. Coxon presiding. The toast of "The Institution" was proposed by Sir William Ray, M.P., executive chairman of the British Electrical Development Association, who pointed out that electrical engineering, from the ordinary point of view, came into the world of engineering somewhat late. In his opinion the future lay with electricity, and it was that consciousness he hoped to bring home to the people of the country. He concluded with a tribute to Birmingham for its wonderful progress in the electrical field. In his reply on behalf of the Institution, Mr. J. M. Kennedy, vice-president, pointed out that the Institution had a real desire to assist the Electrical Development Association. Their interests were complementary. Reports indicated that "the powers that be" had under consideration legislation for the co-ordination of distribution by the merging of the smaller undertakings into the larger. If such legislation were to be successful in achieving the best results, the owners of the large undertakings so created must be subject to some measure of control. They must ensure that electricity supply development would not be hampered by the fear of competition from the gas interests. However rapidly the electrical industry developed, there would be ample time for the gas industry to find additional fields for its enterprise and activity. The Bishop of Birmingham (Dr. E. W. Barnes) responded to the toast of "Kindred Societies and Guests," which was proposed by the chairman.

Fatality

An inquest was held at Halesowen on November 24th on Elsie Allbutt (19), who died suddenly in a hair-dressing saloon on November 7th.

Ethel Pearson, who was with Miss Allbutt, said that after having her hair waved Miss Allbutt was put in the electrical apparatus to have her hair dried. A switch was handed to her by the assistant with instructions how to use it; she was told to touch a certain button if it got too hot. When the assistant went away Miss Allbutt fell to the floor and was afterwards found to be dead.

Leslie Dunn, the proprietor of the establishment, said that the power for the dryer was obtained from the 230-V mains. Periodical examinations were made to see if the apparatus was in proper working order. It had also been examined by the makers at different periods.

Dr. Mather said the girl failed to respond to restoratives. He made a post-mortem examination and found a small burn on the left collar bone and a further burn on the right side of the neck below the angle of the jaw. Dr. Lamb, lecturer on pathology in Birmingham University, said the cause of death was sudden heart failure and respiratory failure following electric shock.

Mr. J. D. Morgan, consulting electrical engineer, Birmingham, said he found no electrical defect in the apparatus, but the insulation of one of the wires was punctured in two places and the cotton covering was frayed so that it exposed the rubber-covered wire within.

The Coroner said the evidence pointed to the fact that the girl had received an electric shock, but he thought that there was no criminal negligence on the part of the owner. The jury recorded a verdict of "Accidental death."

Forthcoming I.E.E. Dinners

The annual dinner of the Western Centre of the Institution of Electrical Engineers will be held on January 15th at the Royal Hotel, Cardiff.

The annual dinner of the North-Western Centre will be held on January 23rd at the Midland Hotel, Manchester. Tickets (10s. 6d. each, exclusive of wine) can be obtained from Mr. A. E. Jepson, hon. secretary of the Centre, c/o the General Electric Co., Magnet House, Victoria Bridge, Manchester, 3.

The E.I.B.A. Ball at Newcastle

A ball in aid of the Electrical Industries Benevolent Association was held at Newcastle-on-Tyne when there were present about 350 members of the electrical industry. A message of good wishes was received from Lord Meston, the national president. Those present included the Lord Mayor of Newcastle (Councillor J. Leadbitter), the Sheriff (Ald. William Locke), Mr. and Mrs. R. P. Sloan, Mr. and Mrs. A. Hughes, and Colonel and Mrs. Monkhouse.

Heating and Breathing

A TECHNICAL report of investigations carried out by the Department of Scientific and Industrial Research and the Medical Research Council into Nose-opening Rays has been issued by the British Electrical and Allied Industries Research Association (Z/T37, 2s. 6d.). The inquiry was undertaken in view of published statements by Prof. Sir Leonard Hill as to the physiological effects of the "dull electric fire" (ELECTRICAL REVIEW, March 18th, 1932). In eighty-five experiments no evidence whatever was found to confirm Sir Leonard's conclusions regarding "nose-opening" rays.

Nose-closing, which was alleged to be due to the infra-red rays associated with the dull electric fire, was found to occur with bright as well as with dull fires and to be produced by convection of heated air or by warm fomentation. The average person tolerates most heating effects without discomfort and without recourse to mouth breathing.

In the preliminary experiments one nostril of the subject was used for respiration and the other was connected by rubber tube to a sensitive manometer of the aneroid type recording upon a moving chart outside the room. An electric lamp, screened by glass, was switched on and off at intervals to illuminate the subject's face. There was no evidence that the inspiratory pressure was less when the lamp was lighted.

Further experiments included placing the subject in an arm-chair (which was screened from draughts and most of the light by a paper shelter) and facing one of a pair of electric fires (one bright, the other dull) at a distance of 6 ft. 6 in. The fires were so mounted on a silently running trolley behind screens of tin and wood that the subject was irradiated by each in turn; the elements of the dull fire had a surface of 2½ times that of the other. The intensity of irradiation upon the face was 65 B.th.u. per sq. ft. per hour, and the temperatures of the elements were 1,600 and 1,350 deg. F. respectively.

Thirty blind men were tested by exposure to the bright and dull fires alternately for nine, three, three, and three minutes. There was again no evidence of any difference in inspiratory pressure due to change of quality of radiation. Fifty-six records were obtained with subjects of both sexes with normal sight, who were prevented from seeing the fires by wearing opaque goggles. The results were similar to those found with the blind subjects.

The ratios of the mean inspiratory pressure with the dull fire to that with the bright fire were determined for each experiment; these ranged from 0.6 to 1.3, but the variations were random and not attributable to change in the quality of radiation. Testing carried out with a clinical gas lamp (of the type especially commended by Sir Leonard Hill) under the same conditions, and with the same intensity of radiation, gave analogous results.

That "nose-closing" is probably caused by any rapid warming of the skin and is not dependent upon any particular quality of radiation was confirmed by further experiments.

Our Personal Column

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

The ELECTRICAL REVIEW congratulates **Sir Hugo Hirst, Bt.**, chairman and managing director of the General Electric Co., Ltd., on the occasion of his seventieth birthday. To few has the privilege been given to note almost the beginnings and certainly the remarkable and consistent growth of Sir Hugo's influence in British electrical affairs during a period of between forty and fifty years. We take advantage of this occasion to wish him, both on our own behalf and on behalf of our readers "Many Happy Returns of the Day" and health to follow his numerous and ever-growing interests. The birthday celebration took several forms. On Sunday last, November 26th, Sir Hugo was entertained to dinner at the Savoy by the directors and managers of the company, and he was presented by his fellow directors with an antique silver salver. Previously a deputation representing 5,000 contributors of all grades of the staff of the G.E.C. at home and overseas, had presented him with a silver Queen Anne loving cup and an illuminated address expressive of their affection and their good wishes for the future.

Elliott & Fry

Sir Hugo Hirst, Bt.

On Friday last, November 24th, his daughter, Mrs. Leslie Gamage, held a reception at the Savoy in honour of his birthday, and those present, in addition to Sir Hugo and Lady Hirst, included Lord and Lady Ashfield, Sir Newton and Lady Moore, Mrs. Byng, Mrs. Ernest Byng, Mr. and Mrs. Eric Gamage, Mrs. A. W. Gamage, Mr. and Mrs. M. J. Railing, and many others.

Mr. G. H. Nelson, managing director of the English Electric Co., Ltd., and **Mr. C. S. Richards,** joint managing director of the Metropolitan-Vickers Electrical Co., Ltd., have, according to a *Reuter* message from Warsaw, arrived in that city to discuss matters in connection with the electrification of Polish railways. Our readers will recall that a contract valued at £1,890,000 was signed in August between the Polish State Railways and the two companies. It is estimated that at least £900,000 will be spent in England on equipment of a kind not manufactured in Poland.

Mr. A. Charlton, managing engineer to the Sheerness and District Electric Supply Co., Ltd., has resigned his position in the company owing to ill-health. Mr. Charlton went to Sheerness in 1914, from Kidderminster, where he was managing engineer. At that time Sheerness possessed trams and motor buses, and Mr. Charlton supervised the transport services in addition to the supply undertaking. The trams were dispensed with and the buses taken over by Standen & Sons under the name of Sheppey Motor Transport, Mr. Charlton becoming a director of the S.M.T., which position he held until the Electric Supply Co. disposed of its interest in the transport company. During his stay at Sheppey, the electricity supply has been extended to Minster and Eastchurch.

Mr. E. Edger

Mr. E. Edger, who has been with the Sheerness Co. for over twenty-five years, has been appointed to succeed Mr. Charlton. Before going to Sheerness in 1908, Mr. Edger was a pupil with the Brush Electrical Engineering Co., Ltd. At Sheerness he has held successively the positions of shift engineer, station superintendent, and chief assistant engineer.

Mr. F. E. Hammond, mains inspector, is retiring from the Edinburgh Corporation Electricity Department after nearly forty years' service.

Mr. J. Soper, for fifteen years on the staff at the power station at Moredon, Swindon, who has retired, has been presented by his colleagues with a gift of Treasury notes. The presentation was made at the works by the borough electrical engineer, Mr. A. Nicklin.

Mr. C. R. Cooper, whose article on "Power Factor Improvement" appears on another page, served his apprenticeship in Messrs. Harland & Wolff's workshops at Glasgow, and took a degree in mechanical engineering at Glasgow University. He then joined the staff of the Glasgow Corporation Electricity Department, and later went to North Borneo as an engineer and, for a time, manager of a factory. At present he is technical assistant in the Statistical Department of the North-Eastern Electric Supply Company, Ltd.

Mr. C. R. Cooper

Mr. H. Fortescue-Flannery, M.B.E., M.I.N.A., has been appointed an advisory director of Callender's Cable & Construction Co., Ltd.

Mr. L. L. Horrell, city electrical engineer of Pretoria, and Mr. M. G. Nicolson, the town clerk, have now arrived in London to conduct negotiations for tenders for electrical plant, and to inquire into transport methods.

Mr. P. Scott

Mr. P. Scott, resident engineer to Messrs. Simon Carves, Ltd., Stockport, has been selected for the position of steam operating engineer with the Hackney electricity undertaking. After serving his apprenticeship with Ashmore, Benson, Pease & Co., Ltd., Mr. Scott joined the Metallurgical Department of Messrs. Simon Carves, Ltd., in 1921, and in the following year was appointed senior draughtsman in the company's Coal Washer Department. In 1925 he became senior draughtsman to Messrs. R. & J. Dempster, Ltd., with whom he remained for one year, then returning to Messrs. Simon Carves.

Mr. L. M. Jockel, M.I.E.E., M.I.Mech.E., power station superintendent at Nottingham, has been appointed generating station engineer to the Hackney Borough Council. Mr. Jockel has been at the North Wilford power station of the Nottingham Corporation for the past eight years.

Mr. R. Illingworth, who was appointed deputy electrical engineer to Poplar Borough Council in July last year, has now been recommended by the Electricity Committee for the appointment of borough electrical engineer. Before going to Poplar Mr. Illingworth was deputy electrical engineer at Plymouth. An account of his career was published in our issue of July 22nd, 1932.

Mr. R. Illingworth

Mr. J. L. Hill, superintending engineer of the South African Department of Posts and Telegraphs, whose impending retirement was announced in our issue of October 27th, has been presented by his colleagues with a cheque, and Mrs. Hill with a silver tea set. Mr. H. J. Lenton, the Postmaster-General of South Africa, made the presentations, and spoke of the excellent work of Mr. Hill, particularly during the past four

or five years, in connection with the extensive programme of development in electrical communication not only in the Union, but with adjoining countries and overseas. Mr. Lenton is visiting England, and is to attend the International Postal Conference at Cairo in February.

It is stated by the American Secretary of State that no further attempts to extradite **Mr. Samuel Insull** can be made so long as he remains in Greece. Protest has been lodged denouncing the extradition treaty between U.S.A. and Greece as worthless.

Mr. J. W. Arthur, assistant electrical engineer to the Reading Electric Supply Co., Ltd., has been appointed acting engineer and manager of the Reading Corporation electricity undertaking, as from January 1st next, at a salary of £1,000 per annum.

Mr. H. Croft has retired from the Vacuum Oil Co., Ltd., on pension after thirty-nine years' service with the company. Mr. Croft joined the company in 1894 and by successive steps became manager of the electrical department, a position which he held until it was absorbed in the general department.

Obituary

Mr. Herbert H. Dewey, vice-president of the International General Electric Co., Inc., died at his home in Schenectady on October 25th, after a short illness. Mr. Dewey graduated from St. Lawrence University in 1904, and joined the General Electric Co., of New York, in 1907 as a student engineer. Two years later he was assigned to the power and transmission section of the power and mining department, and had charge of the section from 1916 to 1921. He was then appointed assistant engineer of the central station department, the power and mining and the lighting departments being consolidated under the name of the central station engineering department. In 1927, and again in 1928, he went to Russia for the company, and in December, 1928, was appointed vice-president of the International Co., with supervision of all interests of the company in connection with Russian business.

Mr. A. J. Greenly.—Mr. Arthur John Greenly, of Greenlys, Ltd., died on November 22nd in a nursing home after a long illness and following an operation. He was forty-nine years of age. He was well known in the electrical and various other industries as an advertising specialist. As readers will remember, we reproduced his portrait in the ELECTRICAL REVIEW of October 20th (p. 573). Mr. Greenly was a past-president of the Batti-Wallahs' Society. The funeral took place at Brookwood, Woking, on Monday, and a memorial service, largely attended by representatives of newspaper interests, industrial and advertising concerns, and the staff of Greenlys, Ltd., was held at Holy Trinity, Brompton.

Mr. R. A. Bachman.—The death occurred on November 23rd at his residence, Old Crest, Redditch, after a short illness, of Mr. R. A. Bachman, managing director of Britannia Batteries, Ltd., at the age of sixty-one. Mr. Bachman was born in America, and followed an engineering career; he was associated for about eighteen years with Mr. Thomas A. Edison. After the closing of the Birmingham Small Arms Works at Redditch in 1928, the works were acquired by Britannia Batteries, Ltd., and Mr. Bachman was appointed general manager. He had been managing director for the last two years.

Mr. L. W. Holmes.—An announcement in *The Times* "Deaths" column states that Mr. Leonard W. Holmes died at Worthing on November 21st.

Mr. A. T. Gomery.—The death occurred suddenly on November 10th, at the age of fifty-two years, of Mr. Albert Thomas Gomery, late overhead and mains superintendent of the Calcutta tramways and Callender's Cable & Construction Co., Ltd.

Mr. A. Miskin.—The death occurred on November 17th, at the age of sixty-four years, of Mr. A. Miskin, joint founder of the firm of Miskin & Rice, electrical engineers and contractors, London Road, St. Albans.

Will.—Mr. James Tennant, a director of the United Alkali Co., and the North-Eastern Electric Supply Co., Ltd., left personal estate in Great Britain valued at £75,404.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Lamp Manufacturing and Railway Supplies, Ltd.—Private company. Registered November 23rd. Capital, £9,000 in £1 shares (5,500 cumulative participating preference and 3,500 ordinary). Objects: To acquire and amalgamate the business in connection with railway and other lamps, formerly carried on by the Lamp Manufacturing Co., Ltd., and also the business formerly carried on by Railway Supplies Co., Ltd., and to carry on the business of manufacturers of and dealers in lamps and lighting and heating apparatus and appliances, &c. The directors are: W. J. Thorn, 38, Bridge Street, Taunton, Somerset; N. K. Farrar Porter, 2, Wardrobe Place, Doctor's Commons, E.C.; and C. F. Minett, 45, South Hill Road, Bromley, Kent. Solicitors: Farrar Porter & Co., 2, Wardrobe Place, Doctors' Commons, E.C.4.

Kolmatic Engineering Co., Ltd.—Private company. Registered November 24th. Capital, £600 in 500 6 per cent. cumulative preference shares of £1 each and 2,000 ordinary shares of 1s. each. Objects: To acquire the business of a combustion engineer carried on by O. S. Lieberg at 1, York Avenue, Browning Street, S.E., and to carry on the business of manufacturers of and dealers in heating apparatus, boilers, boiler equipment, gauges, firebars, firebricks, thermostats, ventilating apparatus, electric motors, separators, electrical and mechanical apparatus and similar goods, &c. The directors are: O. S. Lieberg, "Roslyn," Pine Walk, Carshalton; F. A. T. Heron, The Firs, Ightham Common, Ightham, Kent; and G. C. Thorne, 93, Oxford Road, Gunnersbury, W.4. Secretary: G. C. Thorne. Registered office: 550, Grand Buildings, Charing Cross, S.W.1.

Thermalux Electrical Products, Ltd.—Private company. Registered November 23rd. Capital, £500 in £1 shares. Objects: To acquire any interests and patents relating to the production, treatment, storage, application and distribution of electricity and any apparatus therefor, and in particular to acquire from A. Sykes the benefit of the trade mark "Thermalux" (No. 536931) and the benefit of a certain existing invention relating to an electrically treated overlay (No. 400301) and to carry on the business of electricians, manufacturers and vendors of electrically heated mattress overlays and all component parts thereof, and electrically heated mattresses, blankets and carpets, &c. The first directors are: A. Sykes, 16, Westborough Drive, Halifax; and Fthel Sykes, "Beeches," Green Lane, Burnley Road, Halifax. Solicitors: Longbottom, Horsfield & Fielding, 8, Harrison Road, Halifax.

British Belmont Insulators, Ltd.—Private company. Registered November 23rd. Capital, £200 in £1 shares. Objects: To carry on the business of manufacturers, importers and exporters of, agents for and dealers in electrical, mechanical, musical and scientific instruments and accessories, electrical appliance manufacturers, telephonic, telegraphic, wireless and television apparatus and accessories, &c. The directors are: P. M. Lawrence, 6, Lower Camden, Chislehurst, Kent; and Sara Metliss, 16, Brondesbury Road, Kilburn, N.W.6. Secretary: Sara Metliss. Registered office: 1, Belmont Street, Chalk Farm Road, N.W.1.

Euston Manufacturing Co., Ltd.—Private company. Registered November 22nd. Capital: £2,000 in £1 shares. Objects: To carry on the business of manufacturers of electrical fittings, appliances and accessories, wireless sets and parts, glass, china, porcelain, signs, clocks, and industrial and household apparatus of all kinds, &c. The subscribers are: Constance L. Church, 84, Hurst Grove, Bedford, and F. M. Caporn, 11, Salisbury Square, E.C.4. Registered office: 143½, Euston Road, N.W.1.

Power Radiance & Co., Ltd.—Private company. Registered November 21st. Capital: £1,500 in £1 shares. Objects: To acquire the goodwill of the business of electrical engineers and contractors, wireless dealers, &c., carried on by B. Warren and J. W. Cowling, at 70, Ashby Road, Loughborough, and 87, Conduit Street, Leicester, as the "Power Radiance Company." The permanent directors are: B. Warner, 6, Arthur Street, Loughborough, and J. W. Cowling, 121, Derby Road, Loughborough.

R. & W. (Electrical), Ltd.—Private company. Registered November 21st. Capital: £1,000 in £1 shares. Objects: To acquire the business of car battery service agents carried on by Richardson and Whitaker, Ltd., at Lamb Alley, Bermondsey, and to carry on the business of electrical engineering in all its branches. The first directors are M. C. Richardson and G. R. O. Crole-Rees. Solicitors: J. E. Lickfold & Sons, 17, Bedford Row, W.C.1.

Prestware, Ltd.—Private company. Registered November 21st. Capital: £10,000 in £1 shares (1,000 "A"). Objects: To carry on the business of manufacturers of and dealers in pressed ware and moulded and machine-made goods, rubber, rubber goods, wireless apparatus, metals, vulcanite, ebonite, manufacturers of and dealers in lampwork, radio, electrical and engineering appliances, &c. The directors are: A. Parkinson Threlfall, Bushey Hall Hotel, Bushey, Herts, and two others. Solicitors: Minet, Pering, Smith & Co., 6a, Bedford Square, W.C.1.

Allen & Neale, Ltd.—Private company. Registered November 22nd. Capital: £1,000 in £1 shares. Objects: To carry on the business of electricians, mechanical engineers, manufacturers and workers of and dealers in electricity, motive power and light, &c. The directors are: E. Allen, 6, High Street, Princes End, Tipton, Staffs, and W. Neale, 41, Robert Road, Handsworth, Birmingham. Solicitors: Stockdale & Brown, Victoria Chambers, Wednesbury.

Returns of Electrical Companies

Fairbank Radio, Ltd.—W. Littleton, Broad Street House, E.C.2, was appointed receiver and manager on November 15th, 1933, under powers contained in debentures dated June 23rd, 1932.

English Electric Co., Ltd.—Satisfaction to the extent of £10,100 on July 1st, 1933, of debentures secured by trust deed dated September 15th, 1919, and registered October 3rd, 1919. (Notice filed November 13th, 1933.)

Charlier Bros., Ltd.—Capital, £100 in 1s. shares. Return dated December 30th, 1932 (filed July 1st, 1933). Three shares taken up. 3s. paid. Mortgages and charges, nil.

Telsen Electric Co., Ltd.—First debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated November 9th, 1933, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

Electric Construction Co., Ltd.—Capital, £400,000 in 100,000 cum. 7 per cent preference and 300,000 ordinary shares of £1 each. Return dated June 23rd, 1933. 62,780 preference and 300,000 ordinary shares taken up. £116,490 paid on 36,490 preference and 80,000 ordinary shares, £246,290 considered as paid on 26,290 preference and 220,000 ordinary shares. Mortgages and charges: £113,060.

W. T. Henley's Telegraph Works Co., Ltd.—Capital, £1,000,000 in 40,000 4½ cumulative preference shares of £5 each, and 800,000 ordinary shares of £1 each. Return dated July 21st, 1933. 40,000 preference and 650,000 ordinary shares taken up. £612,4280 paid on 39,880 preference and 413,080 ordinary shares, £237,520 considered as paid on 120 preference and 236,920 ordinary shares. Mortgages and charges: £150,000.

Dawlish Electric Light & Power Co., Ltd.—Capital, £40,000 in £1 shares. Return dated July 7th, 1933. 32,500 shares taken up. £32,500 paid. Mortgages and charges: £1,750.

Pope's Electric Lamp Co., Ltd.—Capital, £25,100 in 25,000 preference and 100 ordinary shares of £1 each. Return dated July 13th, 1933. 23,579 preference and 100 ordinary shares taken up. £5,254 paid, £18,425 considered as paid. Mortgages and charges, nil.

Standard Radio Relay Services, Ltd.—Particulars filed of £70,000 debenture stock and premium of 19 per cent. authorised October 31st, 1933, and covered by trust deed dated November 14th, 1933, charged on 800,000 ordinary 1s. shares in Broadcast Relay Service, Ltd., 3,000 £1 "B" ordinary shares in Nottingham Rediffusion Service, Ltd., and 40,000 1s. ordinary shares in K. L. M. Radio Relays, Ltd., the whole amount being now issued. Trustees: Hoare Trustees, 37, Fleet Street, E.C.4.

Sign Construction Co., Ltd.—Further charge dated November 15th, 1933, to secure £1,000 on the benefit of an agreement dated November 27th, 1931, relating to the construction and maintenance of luminous neon tube electric signs and all moneys due or to become due and payable thereunder as rent or otherwise. Charge on benefit of various agreements, dated November 15th, 1933, collaterally securing £2,200, secured by mortgages dated July 27th and November 15th, 1933. Holders: United Kingdom Advertising Co., Ltd., 25, Shaftesbury Avenue, W.1.

Carfon, Ltd.—Particulars filed of £1,000 debentures authorised October 31st, 1933, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £250.

Concordia Electric Wire Co., Ltd.—Capital: £100,000 in £1 shares. Return dated August 31st, 1933. 57,319 shares taken up. £57,319 paid. Mortgages and charges: £33,000.

Rhondda Tramways Electric Supply Co., Ltd.—Capital, £100 in £1 shares. Return dated August 3rd, 1933. Seven shares taken up. £7 paid. Mortgages and charges, nil.

Six-Sixty Radio Co., Ltd.—Capital, £1,000 in £1 shares. Return dated July 5th, 1933. 970 shares taken up. £970 paid. Mortgages and charges, nil.

Portsmouth Central Wireless Co., Ltd.—Capital, £1,000 in £1 shares. Return dated September 30th, 1933. 675 shares taken up. £675 paid. Mortgages and charges, nil.

John Bennie, Ltd.—Issue on November 4th, 1933, of £1,000 debentures, part of a series already registered.

Upfields Wireless, Ltd.—Satisfaction to the extent of £1,000 on October 21st, 1933, of charge dated November 18th, 1929, and registered November 29th, 1929.

City Notes

Grosvenor Electric Batteries, Ltd.—Presiding at the annual meeting on November 27th, Mr. L. Wells (chairman) said that when an interim dividend was declared for the year ended December last, trading conditions had remained steady, the volume of sales compared favourably with the corresponding period of the previous year, and the rate of profit had been about normal. During the latter period of the financial year, however, serious price competition ensued. A complete change of the system of battery sales took place, with the result that in order to retain customers, orders had to be accepted at a very small or no profit. Generally speaking, they had not suffered from want of orders, and there had been times during the year when they had more orders on their books than they could fulfil. It was not so much loss of business from which they were suffering as absence of profit in business done, and although their sales were lower than in the previous year they were greater in quantity. During the year an improved torch, manufactured from a new composition, had been put on the market. The unreasonable competition which existed could not continue indefinitely and, with a factory now equipped to deal with all their reasonable requirements, the outlook for the future should be more hopeful.

Amalgamated Wireless (Australasia), Ltd., reports a net profit of £82.171 for the year ended June 30th, as compared with £77,159 for the preceding year. A dividend of 8 per cent. for the year has been paid, £20,000 has been allocated to reserves, and £3,056 is carried forward. The directors report that during the year there was an increase in the use of the overseas wireless telephone service operated by the company in conjunction with the Post Office. During the year the service was extended to India, South Africa, parts of Egypt, and elsewhere, and it is estimated that by the aid of this channel the Australian telephone user now has access to more than 30,000,000 telephones throughout the world. The manufacture and sale of the "A.W.A." broadcast receiver has contributed largely to the revenue. During the year the company secured the contract for the erection of one of the principal broadcasting stations in New Zealand, and two smaller broadcasting plants. A subsidiary company has been established for the manufacture of valves.

The East African Power & Lighting Co. has announced an interim ordinary dividend of 3 per cent. (same).

Crompton Parkinson, Ltd., report a profit for the year ended September 30th of £102,187, as compared with £96,309 in the preceding year. Dividends on the 8 per cent. first preference and the 6 per cent. second preference shares are recommended and it is proposed to pay a final dividend of 6½ per cent. (actual) on the ordinary and "A" ordinary shares, making the total distribution for the year 12½ per cent. It is also proposed to place £34,988 to general reserve, and to capitalise £9,988 of that reserve to be distributed to holders of ordinary and/or "A" ordinary shares in the form of new "A" ordinary shares of 5s. each, fully paid, in the ratio of one new share for every twenty shares held. The general reserve account will thus be increased by £25,000 net. The allocations will absorb £69,803, leaving £50,618 to be carried forward.

The British Electric Transformer Co., Ltd., reports a profit for the nine months ended September 30th of £18,463, as compared with a loss of £10,266 for the year ended December 31st, 1932. It is proposed to pay a dividend at the rate of 5 per cent. per annum on the preference shares for the nine months to September, and to carry forward £1,049.

Enfield Rolling Mills, Ltd., reports a net profit for the year ended September 30th, including £690 brought in, of £2,903, which is carried forward. The report states that the company has been chiefly engaged during the year in erection of buildings and plant for the refining of metals and the production of alloys and apparatus for use in the brewing, dairy, food preserving, chemical, pharmaceutical, and other industries. It is anticipated that the new plant will be in full operation early in 1934, when the directors hope for a large and profitable business.

S. Smith & Sons (Motor Accessories), Ltd.—Presiding at the annual meeting held on November 23rd, Mr. W. Henderson-Cleland, in the course of his speech, said there had been a considerable increase in their domestic clock trade. The demand for the Smith synchronous electric clock, made by Smith's English Clocks, Ltd., was rapidly increasing, and to-day they were making more electric clocks than at any time since their introduction two years ago. Ericssons had recently taken a licence from them to manufacture their synchronous motor clocks in Scandinavia and other European countries.

Tube Investments, Ltd., reports a revenue for the year ended October 31st last of £224,286, as compared with £201,853 in the preceding year, to which is added £82,806 brought in, making £307,092. The ordinary dividend is maintained at 8 per cent., the dividend on the liaison ordinary shares absorbs £30,000, and £28,582 is transferred to reserve. The balance carried forward is £84,465. Meeting: December 6th.

The Sphere Investment Trust, Ltd., has made an issue of £250,000 4 per cent. debenture stock at 100¼ free of stamp. This is part of an authorised total of £500,000. The new stock is redeemable at any time in whole, but not in part, at 103.

The Pennsylvania Water & Power Co. has announced the fourth quarterly dividend to December 31st of 75 cents per common share, maintaining the total distribution for the year of $3 per share.

Edmundson's Electricity Corporation, Ltd., is to pay an interim ordinary dividend of 3 per cent., less tax. No interim dividend was paid last year, but the final distribution was 7 per cent.

The Great Northern Telegraph Co., Ltd., has declared a second interim dividend of 2½ per cent., making 5 per cent. to date.

Callender's Share & Investment Trust, Ltd., has given notice of the redemption of its debenture stock on May 31st, 1934.

Stocks and Shares

TUESDAY EVENING.

THE highways of finance continue to be hedged by the apprehensions that spring from violent fluctuations in the dollar. From its lowest point recently touched, the American rate of exchange has rallied to some extent—sufficiently, indeed, to bring about a slightly better tendency in the stocks and shares connected with the United States. The markets for gilt-edged stocks on this side of the Atlantic have partially thrown off the anxiety that possessed them earlier in the month, but prices still show a hesitating tendency. Amongst the stocks of the various public boards connected with electricity, no changes have occurred; there is, however, a general easing of the prices of London Passenger Transport issues. London Power 5 per cent. debenture has declined to 109½. The recently offered 4 per cent. stock is quoted at 104½.

Electricity in the States

Consumption of electricity in the United States of America has continued during the past year at a relatively high level, according to statistics lately announced. But the adoption of the N.R.A. policy, together with fresh taxation by State and Federal Governments, has given rise to increased costs. British holders of American utility stocks and shares have been rather expecting this development for some time past. President Roosevelt has managed to put up the prices of certain raw materials; to his credit, it may be said that he has helped to start revolving the wheels of industry through the medium of increased prices obtained by producers. The utility companies, amongst which the electricity undertakings are some of the most important, have no little difficulty in meeting these increased costs, because, being pseudo-public institutions—although the stocks are privately held—any advance in utility costs is resented by the consumers of electric power. Therefore, while industrial companies are able as a whole to secure advantage by the additional prices, the utility

corporations, which have neither a soul to be saved nor a body to give votes at State and Municipal elections, are peculiarly liable to criticism on the part of their customers if the corporations endeavour to put up prices in correspondence with the extra sums that they themselves are called upon to pay.

This aspect of the question is causing some little anxiety to holders of American utility shares, and the statements quoted above in connection with the United States electricity supply industry are the reflection of a position that seems as though it may become worse before it gets better.

Electricity Supply Shares

Changes of consequence are lacking from the list of Home Electricity Supply shares, but the tone of the market is, if anything, a little easier. Electric Supply Corporations at 78s. 9d. are 9d. down; Lancashires have gone back 1/8 to 35s. No alterations have occurred in the list of London shares. Amongst new issues, West Devon ordinary are steady at 2s. premium, after having touched to 2s. 6d. The Metropolitan Electric new ordinary shares are quoted at 12s. premium. Tokyo 6 per cent. bonds at 76½ are rather easier on the week. Prussian Electric 6 per cent. bonds shed 10 points, going back to 55.

Cables and Wireless

Further declines have lowered the prices of Cables & Wireless stocks to 22½ for the "A" ordinary, and 70½ for the 5½ per cent. preference stocks. Speculation is taking no interest in the group at the present time. Moreover, while domestic trade within Great Britain continues to improve, there seems to be a lag in the export business, and this naturally reacts upon companies, such as Imperial & International Communications, that are concerned mainly with external industries. American Telephone & Telegraph, after a drop to 112, firmed up to 116½. On the other hand, International Telephones at 13 are 1¼ lower. Anglo-American Telegraph preferred and deferred are both down, by reason of the uncertainty brought about by abrupt fluctuations in the value of the dollar. Marconi Marine remain heavy at 26s. 3d. Western Unions relapsed to 52½, showing a fall of 3. Dollar stocks have been moving in close correspondence with the erratic fluctuations of American exchange.

Tales of a Grandfather

Siemens are unchanged at 20s. The company is paying no interim dividend this time, but a year ago 2½ per cent. was distributed, as mentioned here on November 17th. Last week, however, it was inadvertently stated that Siemens paid no interim dividend in 1932. For which regretted slip, may the apologetic suggestion be tendered that the excitement of becoming a grandfather for the first time is liable to exercise a disturbing effect, when the news is brought at the moment at which these paragraphs are being penned.

Manufacturing and Equipment

General Electric ordinary have receded to 41s. 3d., the preference, however, maintaining their price at 32s. Callenders are 1/8 lower at 63s. 9d. The company guarantees the outstanding 5 per cent. debenture stock of Callender's Share & Investment Trust. The directors of the latter have given notice of their intention to redeem the outstanding £115,000 debenture stock on May 31st next. Henleys and British Insulated are lower. Ever-Ready shares eased off to 29s. 6d. Falls have taken English Electric ordinary to 7s. 6d., and the preference to 11s. 3d. Ferranti preference make a bright spot with a rise to 28s. 3d. Enfield Rolling Mills, which have been an active market during the past few weeks, are easier at 26s, on the absence of a dividend. The capital of the company is now half a million pounds sterling, and when the balance-sheet came out, there was £275,000 issued. The report stresses the impression that as soon as the enlarged works are operating at capacity, a large and profitable business should be readily built up. This may be expected early in the New Year. Philips Incandescent Lamps have lost a trifle at 42s. 6d. Ericsson Telephone ordinary maintain their advance to 57s., which is ex the recent dividend. Hall's Telephone Accessories at 20s. 6d., are also ex dividend.

Crompton Parkinson

One of the recent features of the market in the shares of manufacturing and equipment companies has been the substantial rise in the price of Crompton Parkinson ordinary shares. Demand suddenly arose upon hints that the forthcoming report would make an exceptionally good showing, and the price went up abruptly to 22s. 6d. The accounts now published show that the profits for the year ended for September last were £102,000, being about £6,000 higher than those of the previous twelve months. A dividend of 6½ per cent., actual, upon the ordinary and "A" ordinary shares is declared, making 12½ per cent. for the year, against 22½ per cent. A bonus is to be given, however, in the shape of new "A" shares of 5s. to all ordinary shareholders, in the ratio of one new share for twenty old shares held. It may be recalled that at the beginning of the current year the company issued 173,000 6 per cent. preference shares in order to deal with the expansion of the lamp business. The news of a bonus issue has had no effect upon the price of the existing shares.

Iron and steel issues are dull. Babcocks are 6d. down at 38s. 3d. Vickers shaded off to 8s. Nothing has happened to disturb the tranquil somnolence of the rubber share market.

Share List of Electrical Companies

HOME ELECTRICITY COMPANIES.

	Nom.	Approx. Dividend. 1931.	1932.	Price, Nov. 28.	Rise or Fall.	Yield p.c. £ s. d.
Bournemouth and Poole	1	15	15	78/3	—	3 17 0
Brompton Ordinary	1	8½	7	34/–	—	4 2 4
Charing Cross Ordinary	1	8½	7	34/6	—	4 1 2
Chelsea	1	8½	7	33/6	—	4 3 7
City of London	1	10	10	35/–	—	4 0 0
Clyde Valley	1	7	7	40/–	—	3 10 0
County of London	1	10½	10½	55/–	—	3 12 8
Edmundson's 7% Pref.	1	7	7	34/–	—	4 2 4
Elec. Dis. Yorkshire	1	9	9	46/3	—	3 18 0
Elec. Supply Corporation	1	11	11	78/9	—9d.	2 15 6
Kensington Ordinary	1	8	7	34/–	—	4 2 4
Lancs Light and Power	1	7	7	35/–	—⅛	4 0 0
London Electric	1	9	7	34/6	—	4 1 2
Metropolitan	1	10	10	52/6	—	3 16 0
Midland Counties	1	7	7	37/–	—	3 15 8
Mid. Elec. Power	1	8	8	45/–	—	3 11 1
North Eastern Electric Ordinary	1	6	6	34/–	—	3 10 8
Do. 7% Pref.	1	7	7	34/–	—6d.	4 2 4
Northampton	1	10	10	55/–	—	3 12 9
Notting Hill 6% Pref.	10	6	6	13¾	—	4 8 11
North Met. Elec. 6% Pref.	1	6	6	30/–	—	4 0 0
St. James' and Pall Mall	1	8	7	34/–	—	4 2 4
Scottish Power	1	8	8	38/9	—	4 2 6
South London	1	8½	7	34/6	—	4 1 2
Westminster Ordinary	1	8½	7	34/6	—	4 1 2
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	17/6	—	8 11 6
Yorkshire Elec.	1	8	8	46/3	—	3 9 3

PUBLIC BOARDS.

Central Electricity, 1950–70	Stock	5	5	114	—	4 7 6
Do. 1951–73	,,	4½	4½	108	—	4 3 4
Do. 1963–93	,,	—	3½	93	—	3 15 3
London & Home Counties, 1955–75	,,	4½	4½	110	—	4 1 10
London Passenger Transport, A	,,	—	4½	116½	—½	3 17 3
Do. do. B	,,	—	5	120	—1	4 3 4
Do. do. C	,,	—	—	80	—1	—

TELEGRAPH AND TELEPHONES.

American Tel. & Tel.	$100	9	9	116½	+2	7 14 3
Anglo-Am. Tel. Pref.	Stock	6	6	114	—1½	5 5 3
Do. Def.	,,	1½	1½	29½	—½	5 1 8
Cables & Wireless 5½% Pref.	,,	2¾	2¾	70½	—1	3 17 0
Do. A 7½% Ord.	,,	Nil	Nil	22½	—½	—
Do. B Ord.	,,	Nil	Nil	10½	—½	—
Globe Tel. and T. Ord.	10	Nil	2½	10	—	2 10 0
Do. do. Pref.	10	6	6	12½	—	4 16 0
Great Northern Tel.	10	20	20	31½	—½	6 7 0
Marconi-Marine	1	10	7½	26/3	—	5 14 3
Oriental Telephone Ord.	1	12	12	3⅛	—	*3 18 4

HOME AND FOREIGN TRAMS, ETC.

Anglo-Arg. Trams First Pref.	5	Nil	Nil	3/3	—	—
Do. do. 2nd Pref.	5	Nil	Nil	1/6	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	6	—	—
British Electric Traction Df. Ord.	,,	5	5	450xd.	—25	—
Do. do. Pref. Ord.	,,	8	8	144½	—	5 10 9
Brazil Traction	100	—	—	11⅜	+⅛	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	103	—	4 17 0
Mexico Trams, 5% Bonds	—	5	5	27½	—	18 3 8
Mexican Light Common	100	Nil	Nil	7½	—	—
Do. 7% Pref.	100	7	7	11	—	—
Do. 1st Bonds	—	5	5	40	—5	12 10 0
Victoria Falls Ord.	1	15	20	5⅛	—	3 19 0
Yorkshire (West Riding)	1	Nil	Nil	15/–	—	—

MANUFACTURING COMPANIES.

Assoc. Elec. Ord.	1	4	4	17/9	—	4 10 4
Do. Pref.	1	8	8	33/3	—	4 16 6
Babcock & Wilcox	1	14	9	38/3	—6d.	—
British Aluminium Ord.	1	5	5	28/–	—6d.	3 11 2
British Insulated Ord.	1	15	15	71/3	—⅛	4 4 0
Brush Ord.	Stock	Nil	Nil	40	—	—
Callender's	1	15	15	63/9	—⅛	4 14 4
Do. 6½% Pref.	1	6½	6½	31/3	—	4 3 2
Crompton Parkinson Ord.	5/–	22½	12½	22/6	—	—
Do. 8% Pref.	1	8	8	31/3	—	5 2 5
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	6 2 5
Do. 5% Deb.	Stock	5	5	102½	—	4 17 7
Electric Construction	1	Nil	Nil	10/–	—	—
Enfield Cable Ord.	1	25	25	93/9	—⅛	5 6 5
English Electric	1	Nil	Nil	7/6	—9d.	—
Do. do. Pref.	1	Nil	Nil	11/3	—⅛	—
Ever Ready	5/–	35	35	29/6	—6d.	5 18 8
Ferranti Pref.	1	7	7	28/3	+9d.	4 19 1
G.E.C. Pref.	1	6½	6½	32/–	—	4 1 2
Do. Ord.	1	8	8	41/3	—1s.6d.	3 17 0
Henley's	1	30	30	6⅛xd.	—⅛	4 17 1
Do. 4½% Pref.	5	4½	4½	5½	—	4 5 9
India-Rubber Preferred	1	—	—	16/3	—	—
Johnson & Phillips	1	5	5	19/6	—	5 2 7
Siemens Ord.	1	7½	6½	20/–	—	—
Telegraph Construction	£1	Nil	Nil	28/9	—	—

* Dividends paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings taken.

1932

2748. "Electric control circuits for hot-cathode electric discharge tubes." British Thomson-Houston Co., Ltd. January 29th, 1931. (400918.)

5597. "Electric signalling, supervising, and recording systems." J. R. Harrington. February 6th, 1932. (400973.)

5412. "Conversion of electric currents." E. Marx. February 23rd, 1931. (400934.)

5826. "Methods of transforming alternating current of one frequency into alternating current of another frequency." J. Gray (Allgemeine Elektricitäts Ges). February 26th, 1932. (400919.)

6136. "Electric disconnecting or fuse boxes, boards, or the like." A. F. M. Gatrill. March 1st, 1932. (400935.)

9651. "Oscillatory electric circuits, such as may be used, for example, in connection with cathode-ray devices." Electric & Musical Industries, Ltd., and A. D. Blumlein. April 4th, 1932. (400976.)

11159. "Building construction and method of electrically wiring a building." H. H. Robertson Co. August 26th, 1931. (400924.)

11756. "Coin-freed apparatus such as telephone pay stations." J. E. Pollak (Associated Telephone & Telegraph Co.). April 23rd, 1932. (400952.)

11937. "Electric power-transmission systems." British Thomson-Houston Co., Ltd., H. Orchard and J. A. Jaffrey. April 26th, 1932. (400955.)

12101. "Electric cables." W. T. Henley's Telegraph Works Co., Ltd., and P. Dunsheath. April 27th, 1932. (400929.)

12520. "Incandescent cathodes for gasfilled discharge devices." Jenaer Glaswerk Schott & Gen. May 6th, 1931. (Addition to 380025.) (400981.)

12750. "On-load tap-changing arrangements for electric transformers." British Thomson-Houston Co., Ltd., and G. C. Mayo. May 3rd, 1932. (400962.)

12752. "Electric cable sealing units for distributing pillars and the like." British Thomson-Houston Co., Ltd., and P. H. Harding. May 3rd, 1932. (400963.)

12760. "Submarine electric cables." Electrical Research Products, Inc. May 26th, 1931. (400964.)

12765. "Electric light reflectors." E. J. Stockwell. May 3rd, 1932. (400982.)

12885. "Electrical measuring or relay apparatus, particularly for high-potential circuits." British Thomson-Houston Co., Ltd., J. G. Wellings, and C. G. Mayo. May 4th, 1932. (Addition to 372404.) (400985.)

13129. "Electric discharge rectifiers." International General Electric Co., Inc. May 6th, 1931. (400994.)

13138. "Electrical oscillation generators." Marconi's Wireless Telegraph Co., Ltd., and N. M. Rust. May 6th, 1932. (400995.)

13160. "Electron-discharge tubes." Standard Telephones & Cables, Ltd., W. E. Benham, and F. D. Goodchild. May 6th, 1932. (400999.)

13306. "Coin-controlled electrical switches for wireless receiving sets." L. T. F. Dobell, J. G. Hassell, and A. F. Palfreman. May 9th, 1932. (401007.)

13354. "Windings of dynamo-electric machines." International General Electric Co., Inc. May 9th, 1931. (401009.)

13356. "Compensation of three-phase potential transformers." British Thomson-Houston Co., Ltd., and C. G. Mayo. May 9th, 1932. (401010.)

13377. "Electric switches and circuit-breakers." W. B. Whitney, E. B. Wedmore, and British Electrical & Allied Industries Research Association. May 9th, 1932. (401013.)

13538. "Electro-magnetically operated switches." T. Harvey. May 11th, 1932. (401017.)

14613. "Production of electrically-conducting coatings." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. October 27th, 1931. (401022.)

15444. "Coil-winding machines." A. C. Cossor, Ltd., and J. E. Blakshaw. May 31st, 1932. (401027.)

15710. "Composite materials having electrically conducting and insulating components and electrical devices comprising the same." Naamlooze Vennootschap Hollandsche Draad-en Kabel-Fabriek. May 7th, 1932. (401001.)

15944. "Supports for electrical heating resistances." Siemens & Halske Akt.-Ges. June 6th, 1931. (401030.)

15963. "Construction of totally-enclosed electric motors." P. A. H. Mossay and W. H. Scott. June 6th, 1932. (401031.)

16290. "Electrical signalling systems." T. H. Flowers. June 9th, 1932. (401033.)

16447. "Lighting appliances." General Electric Co., Ltd., and E. L. B. Damant. June 10th, 1932. (401034.)

18474. "Covers of electric tumbler switches." J. A. Crabtree. June 30th, 1932. (401049.)

19789. "Snap-action electric switches." J. G. Smithson. July 13th, 1932. (Cognate application 29947/32.) (401057.)

20090. "Cells showing the Kerr effect." T. W. Case. July 15th, 1932. (401059.)

21428. "Electric signs." Claude-General Neon Lights, Ltd., and W. R. Webb. July 29th, 1932. (401064.)

21924. "Protective arrangements for electrical machines and transformers." T. W. Ross and Associated Electrical Industries, Ltd. August 4th, 1932. (401067.)

25895. "Electric conductors suitable for high-frequency transmission." British Insulated Cables, Ltd., and A. L. Blake. September 17th, 1932. (401082.)

26029. "Methods of manufacturing electrical coils." British Thomson-Houston Co., Ltd. September 18th, 1931. (401084.)

26162. "Electric lighting installations." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. December 2nd, 1931. (401086.)

27935. "Electric fuses." International General Electric Co., Inc. October 7th, 1931. (401097.)

36356. "Electric lamps." British Thomson-Houston Co., Ltd., and General Electric Co., Ltd. December 22nd, 1931. (401128.)

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4374. "Electrical means for indicating measured values." International General Electric Co., Inc. February 12th, 1932. (401150.)

4555. "Illuminated signs." General Electric Co., Ltd. March 10th, 1932. (401151.)

6025. "Electric couplings of the plug-and-socket type." British Brass Fittings, Ltd., and G. N. Sperryn. February 28th, 1933. (401161.)

6769. "Prepayment meters." International General Electric Co., Inc. March 5th, 1932. (401165.)

7357. "Electric circuit interrupters." Westinghouse Electric & Manufacturing Co. March 18th, 1932. (401166.)

7553. "Control systems for electrically driven vehicles." Maschinenfabrik Oerlikon. April 22nd, 1932. (401168.)

10704. "Electric battery lamp." J. Neu and J. Neuburger. March 4th, 1933. (401179.)

10821. "Thermionic valve arrangements." Telefunken Ges. für Drahtlose Telegraphie. April 11th, 1932. (401182.)

11595. "Welding electrodes." M. Zack. July 18th, 1932. (401186.)

11918. "Recording of sound." Radio Corporation of America. July 11th, 1932. (401192.)

14171. "Electric welding machines." British Thomson Houston Co., Ltd. May 17th, 1932. (401208.)

15842. "Automatic circuit-breakers." H. Schneider-Clerc. June 1st, 1933. (401221.)

19741. "Electric discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. July 27th, 1932. (Addition to 392796.) (401240.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from November 22nd:—

Sunspot Auto Bulb (lettering and design). No. 543310. Class 13. Electric lamps (ordinary) for motor car use.—Nivalight (1928), Ltd., 30, Islington Green, N.1.

Goodyear (lettering and design). No. 545484. Class 13. Sparking plugs.—Goodyear Tire & Rubber Co., Akron, O. U.S.A. (British representatives: Mewburn, Ellis & Co., 70-72, Chancery Lane, W.C.2.)

Hadmang. No. 542272. Class 50. Electrodes of ordinary metal.—Hadfields, Ltd., Vulcan Street, Sheffield.

The Fuel Research Board's Work

THE Department of Scientific and Industrial Research has issued the annual report of its Fuel Research Board for the year ended March 31st, 1933 (H.M. Stationery Office, price 2s. 6d. net).

This states that a considerable amount of work has been done during the year on pulverised coal, which has for many purposes advantages in ease of handling and control approaching those of oil fuel, while at present prices it is considerably cheaper. The main direction of the work has been towards the production of short-flame burners for pulverised fuel for use where the combustion space is limited, as, for example, on board ship. The "Grid" burner developed at the station has already attracted considerable commercial interest on account of its flexibility in operation, its simplicity, and cheapness. Another type in process of development employs the principle of the vortex ring to control the emission of the air and particles of fuel, so as to enable heat to be generated in a small space.

The "Z" burner, a very recent development, will, if successful, it is stated, be simpler than any yet tried. Other investigations summarised in the report deal with the sampling of powdered coal, the influence of the type of grinding mill, and the type of coal on the structure and composition of the powdered coal, and with the ease of ignition of various types of coal-dust.

In the study of methods for the cleaning of fine coal considerable progress has been made with a dry-cleaning process designed at the Coal Survey Laboratory at Sheffield. The report suggests that, apart from the cost of the cleaning, it may be possible to make coal too clean. The different inorganic constituents of the coal are often removed in different proportions, and thus the fusion point of the ash may depend on the amount of cleaning carried out; the fusion point of the ash may be of more practical importance than the actual amount of the ash. The mechanical stokers now generally used in large boiler plant were originally designed to burn a small and not very clean coal, of which large quantities were available at a low price. If a very clean coal is used with such appliances the grate may become over-heated owing to the absence of a protecting layer of ash.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aldershot.—Hospital extensions, including children's ward, for the Management Committee; secretary.

Ayr.—Extension to premises, High Street, for F. W. Woolworth & Co., Ltd.; the manager.

Ayrshire.—Extension, St. Margaret's R.C. School (£9,000); clerk, County Council.

Barnsley.—Houses (12); F. Birkinshaw, architect, 30, Pogmoor Road, Church, Old Town; Jackson & Fox, architects, Harrison Road, Halifax.

Berkshire.—Mental office extensions (£21,687), for the Mental Hospital Board; clerk, Reading.

Bexhill-on-Sea.—Houses (16), Crowmere Avenue; J. E. Maynard, architect. Additions to Bolebroke Hotel, Cantelupe Road; E. Bunce, architect.

Billericay.—Shops, Bowers Gifford, for E. R. Turner (Pitsea), Ltd.

Birmingham.—Houses (300), Coventry Road, Sheldon; Biddle & Homer, builders, 20, Waterloo Street. Stores for the Co-operative Society, Ltd., Marsh Lane; works department, Co-operative Society, builders, Holt Street, Aston. Additions to Bagot Street for the Midland Counties Dairy, Ltd. (£50,000), with electrical work; Whittall & Sons, builders, Lancaster Street. Extensions, Bakelite, Ltd., works, Redfern Road, Tyseley (£6,000), with electrical work; Harrison & Cox, architects, 109, Colmore Row.

Blackburn.—Additions to works of British Northop Loom Co., Daisyfield; J. Gerrard & Sons, contractors, Pendlebury Road, Swinton, Manchester.

Bournemouth.—Development of Coast Guard site, Southbourne; Rumsey & Rumsey.

Bridlington.—Concert hall, Lloyd Victoria Gardens; borough surveyor.

Bromley (KENT).—Houses (80), Beverley, Bromley Common; W. E. & S. Rumph, builders.

Canvey Island (ESSEX).—Public offices; P. G. W. Stokes, U.D.C. surveyor, Long Road.

Chelmsford.—Additions to works for the Hoffmann Manufacturing Co., Ltd.

Cobham (SURREY).—Cinema for the Odeon, Ltd.

Cranbrook (KENT).—Houses; A. J. Parker, builder, London Road, Southborough, Tunbridge Wells.

Crowborough (SUSSEX).—Motor showrooms and garage, Beacon Road; Capt. C. M. J. Barrington.

Croydon.—Houses (14), Temple Road; B. M. Brown. Stores, North End; Hillier, Parker, May & Rowden.

Cudworth (YORKS).—Re-erection of R.C. church (£12,000); Rev. Father McGillcuddy.

Derby.—Extensions, Royal Infirmary (£70,000); clerk to the Governors.

Derbyshire.—School, Midway, for County E.C.; education architect, Derby.

Devonshire.—Elementary school, Hayes Road, Paignton, for County E.C.

Dorset.—Library headquarters, Dorchester (£2,000), for C.C.; county architect.

Dudley.—Works, Birmingham-Wolverhampton Road, for Dudley & Co.; Groveland Road, Dudley Port.

Dumfries.—Extension, factory (£5,000) for Wolsey, Ltd., Leicester; Barbour & Bowie, architects, Castle Street.

Edinburgh.—Engineering garage, workshops, &c., Macdonald Road; architect, Commissioners of H.M. Works, 122, George Street. Offices, Russell Road and Roseburn Street for the Scottish Motor Traction Co., Ltd., 49, Queen Street; J. R. McKay, architect, 4, Melville Street.

Enfield.—Houses (36), Graeme Road; Bowyer & Bowyer. Six shops and houses, Green Street; Oatlands Estate, Ltd.

Epsom.—R.C. schools, the Clock House, Dorking Road; Rev. R. Christall.

Fair Oak (WINCHESTER).—Houses (75), for E. A. Udall, builder, Southampton.

Fleetwood.—Factory, Blakiston Street, for the Industrial Co-operative Society, Ltd., Kemp Road; C. Atkinson, 113, Darbishire Road.

Gateshead-on-Tyne.—Houses (80), Saltmeadows Estate; F. H. Patterson, borough engineer.

Glasgow.—Additions to Victoria Infirmary (X-ray room, &c.); Watson, Salmond & Gray, architects, 242, West George Street.

Glossop.—Extensions, West End School, for E.C.; builders, T. Aldons & Son, 1, Marlow Street, Hadfield.

Gravesend.—Laboratory, Albion Parade; Imperial Paper Mills, Ltd. Swimming baths; borough engineer.

Guildford.—Development of Boxgrove Estate; A. C. Burlingham.

Hampshire.—School, Hardley (£9,710), and extensions, Eastleigh Senior schools, for County E.C.; A. L. Roberts, county architect, the Castle, Winchester.

Harmsworth Hall (LINCOLN).—Installation of electric lighting, &c.; Colony for the Joint Board for the Mentally Defective; E. G. Phillips, Queen's Chambers, King Street, Nottingham.

Hatfield.—Works, with office block, technical school, staff welfare centre, &c., for the De Havilland Aircraft Co., Ltd., Stag Lane, Edgware, Middlesex.

Herne Bay.—Extensions, St. Mary's Holiday Home, Buller's Avenue; Sterret, Glover & Diplock, architects.

High Wycombe.—Schools, Harlow Road, for St. Augustine's Roman Catholic managers; secretary.

Hoole.—Houses (60); E. H. Rigby, clerk.

Irish Free State.—(BALLYSHANNON, CO. DONEGAL).—Houses (80), Flower Estate; McDonnell, Dixon & Downes, architects, 20, Ely Place, Dublin. (KILLARNEY, CO. KERRY).—Additions and alterations to mental hospital, for the Committee of Management; J. R. Boyd Barrett, chartered architect, 61, South Mall, Cork. (ROSCREA, CO. TIPPERARY).—New wing to hospital, Shan Ross Abbey, for the Rev. Mother of the Nuns; T. J. Cullen, architect, 25, Suffolk Street, Dublin.

Isle of Ely.—Extensions, casual wards (£2,800), Wisbech, for C.C.

Kettering.—Extensions of premises for the Clothing Manufacturing Co-operative Society, Ltd., Dryden Street; P. Cook, R. J. Williams & Co., Park Style Chambers, Market Street.

Kingsbury.—Shops and flats, Church Lane; P. P. Langdell, 174, Greenford Road.

Kinver (STOURBRIDGE).—Houses (32); R.D.C. surveyor.

Lancashire.—School, Darwen, and extensions, Grammar School, Chadderton (£7,729), and Grammar School, Newton in Makerfield (£5,000), for County E.C.

London.—(BERMONDSEY).—Four storey block of dwellings, White's Grounds; borough surveyor. (CATFORD).—Development of Woodlands Estate; P. B. Dannatt. (EALING).—Development of Park Royal Estate; Allnatt, Ltd. Factory for the Burrell Radio, Ltd., Bilton Road; P. Bilton, Ltd. (GREENWICH).—Extensions, Municipal offices, London Street; borough engineer. (LEWISHAM).—School, Honor Oak Estate (£28,500); L.C.C. architect. (POPLAR).—Additions to Woodland Works, Wick Lane; Lupton & Sons. (STOKE NEWINGTON).—Extensions, Carysfoot Street, for Ever Ready Co. (Gt. Britain), Ltd.; H. Seymour Couchman & Sons. (TOTTENHAM).—Extensions, 807, High Road; North Metropolitan Electric Power Co., Ltd.

Macclesfield.—Infants' school, Moss Lane, for E.C.; H. Quentery Farmer, architect, 102, Brook Street, Cumberland Street. Extensions, Athey Street Council School for mentally defective children; E. Hamson, borough surveyor, Town Hall.

Mauchline (AYRSHIRE).—Re-erection of works for W. & A. Smith.

Melksham.—Factory extensions, Avon India Rubber Co., Ltd.; secretary.

Middlesbrough.—Houses, Green Lane; W. A. King & Sons, builders, Westbourne Grove. Shops and offices, Eastbourne Road; Kitching & Co., architects, 21, Albert Road. Swimming baths and branch library; S. E. Burgess, borough engineer.

Middlesex.—Secondary school, Broadfields Park Estate, Edgware, and technical institute, the Boroughs, Hendon, for County E.C.

Morley.—Extensions, Peel Street Elementary School; P. Turner, borough engineer, Town Hall.

Mossley (LANCS).—Re-erection of Vale Mills for George Lawton & Son, Ltd., Micklehurst.

Newbury.—Extensions, Albert Works, Albert Road; Elliotts of Newbury, Ltd.

Newcastle-on-Tyne.—Houses (12), Earl's Drive; Longstaff & Bain, builders, Denton Road. Factory, Foundry Lane, for Faith, Ltd.; J. C. Clarkson, builder, Matilda Street. Hotel for James Deuchar, Ltd., Armstrong Road; Marshall & Tweedy, architects, 129, Pilgrim Street. Alterations to premises, Westgate Road, for the Northern General Transport Co.; Elliott Bros., builders, Jesmond. Conversion of St. Paul's Church into cinema; Henderson Brothers, builders, South Shields. Extensions and alterations to St. Aloysius schools; R. Burke, architect, 12, Grey Street.

Northam (DEVON).—Public offices; J. L. Harris, builder.

Nutfield (SURREY).—Aerodrome, with flying school and headquarters (£15,000), for the British Air Transport, Ltd.

Paignton.—Houses (15), Sparks Barn Road; F. G. Stockman. Estate development, Dunstone Park; Mitchell Bros. Shops, Torbay Road; German & Son. Additions to Benfield Hotel: T. H. Ismay.

Portsmouth.—Houses (22), Hawthorn Crescent; G. & W. Mitchell. Block of flats, Campbell Road; Captain G. E. Couzens.

Quarry Bank.—Works extensions, Tubular Holloware Co., Hope Street, and the Bank Hardware Maufacturing Co., New Street.

Romiley (CHESHIRE).—Cinema, Compstall Road; A. Winstanley, architect, Great Ducis Street, Manchester.

Rubery (WORCESTERSHIRE).—Houses (60), new road, near Bristol Road South; Fairclough Biston & Co., architects, 38, Bennett's Hill, Birmingham.

Rutherglen.—Houses (150), electrical work; H. Inglis, burgh surveyor, Town Hall Buildings.

Salford.—Works extensions for S. C. Brewster, Ltd. Egerton Street; C. H. Normanton & Son, Ltd., builders, Manchester.

Scarborough.—Houses (57); J. P. Watson, borough engineer.

Southend-on-Sea.—Houses, with electrical work; Earls Hall Garden Estate Co.

Stokesley.—Houses (40); R.D.C. surveyor.

Sunderland.—Schools, Ford Estate; Randle & Co., builders, Dunelm.

Sutton (SURREY).—Cinema, Carshalton Road; William Blay, Ltd., builders, Dartford.

Thorne (YORKS).—Sewage pumping works (electrical work), Hatfield; J. T. Smith, clerk.

Thornton Heath (SURREY).—Alterations and additions to 746, London Road; Boots (Southern), Ltd.

Tunbridge Wells.—Assembly hall (£40,000); borough engineer.

Wadhurst (SUSSEX).—R.C. school, &c., Mayfield Lane; Rev. Father Fothergill.

Wallsend.—Factory, Gut Road; R. Hood Haggie & Son, Ltd.

West Hartlepool.—Extensions to nurses' quarters, Howbeck Institution (£5,000); Public Assistance Committee.

West Riding.—School, Goldthorpe; H. Wormald, County Hall, Wakefield.

West Sussex.—Nurses' home Horsham Institution (£6,750); county architect, Chichester. Schools, Lancing and Shoreham, for County E.C.; Evan T. Davis, secretary, Chichester. Senior school, Southwick (£10,495); J. Drewitt & Sons, Ltd., builders.

Whitby.—Conversion of the Coliseum into cinema, for the New Empire Theatre Co., Ltd.; secretary.

Whittlesey.—Alterations to cinema; C. S. Hart.

Wolstanton (STAFFS).—Houses (600), Highfield Farm Estate; Estate Co.